JULY, 1928

Railway Engineering and Maintenance

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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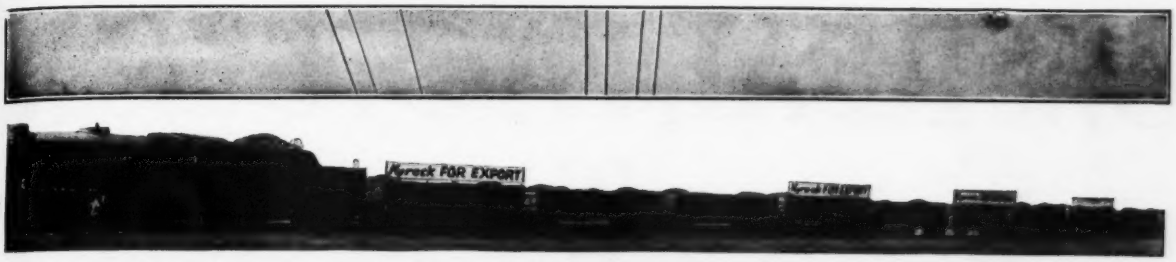
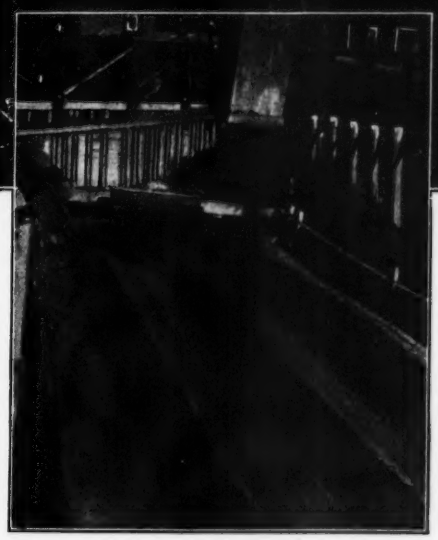


One of two trains of 44 cars of Kyrock loaded out on March 30, 1928, for paving 30,000 sq. yds. of streets in a South American city.



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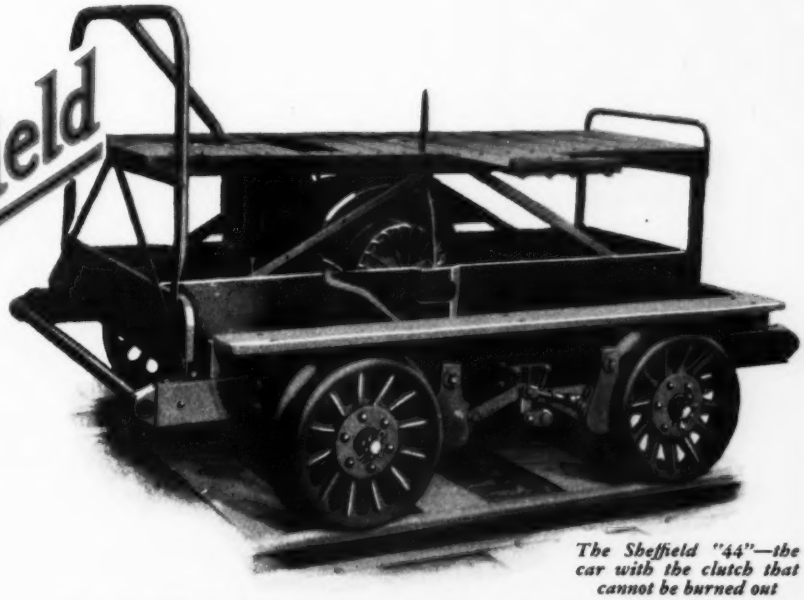

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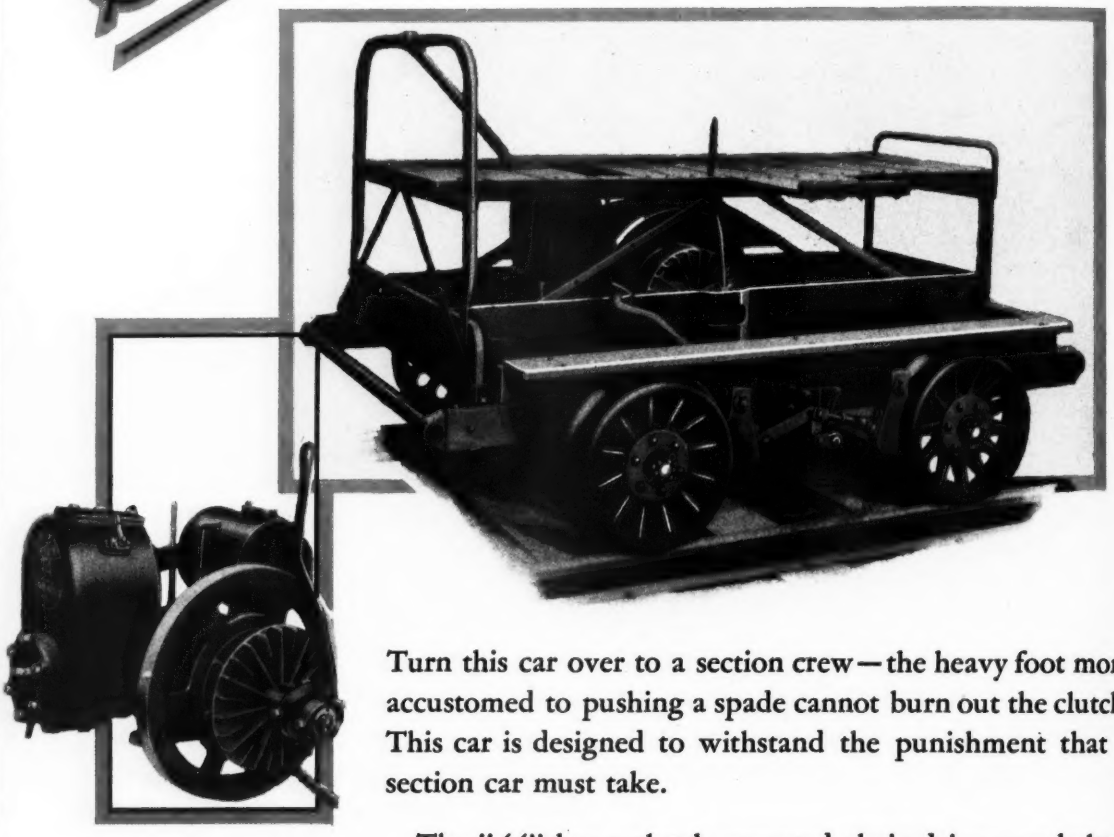

The engine and transmission on a "Sheffield 44." Note the clutch with its special plates and cooling fins

Turn this car over to a section crew—the heavy foot more accustomed to pushing a spade cannot burn out the clutch. This car is designed to withstand the punishment that a section car must take.

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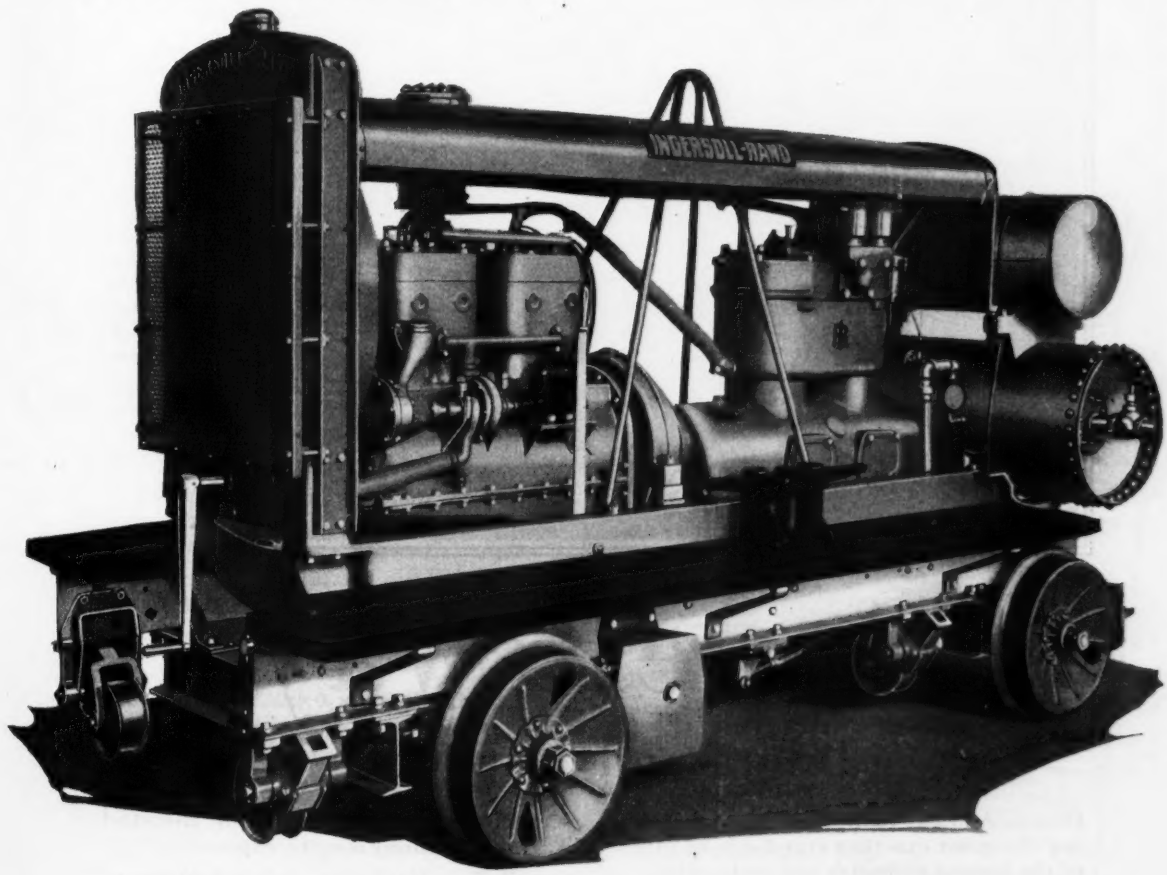

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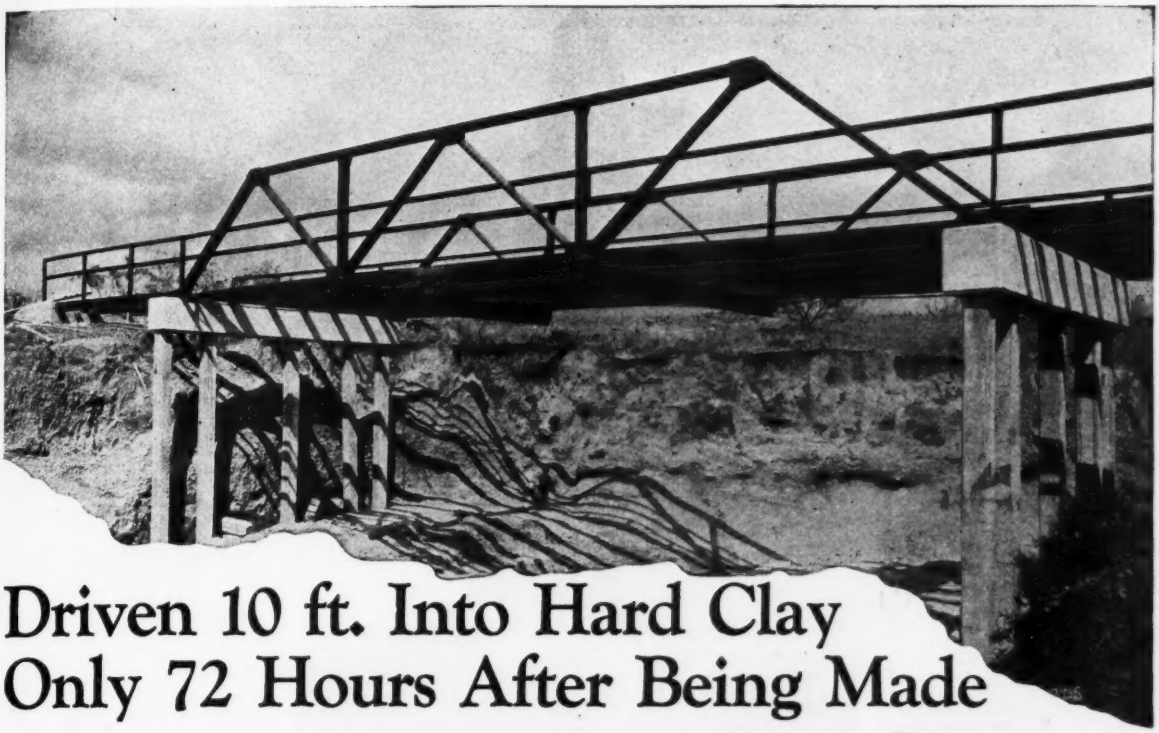

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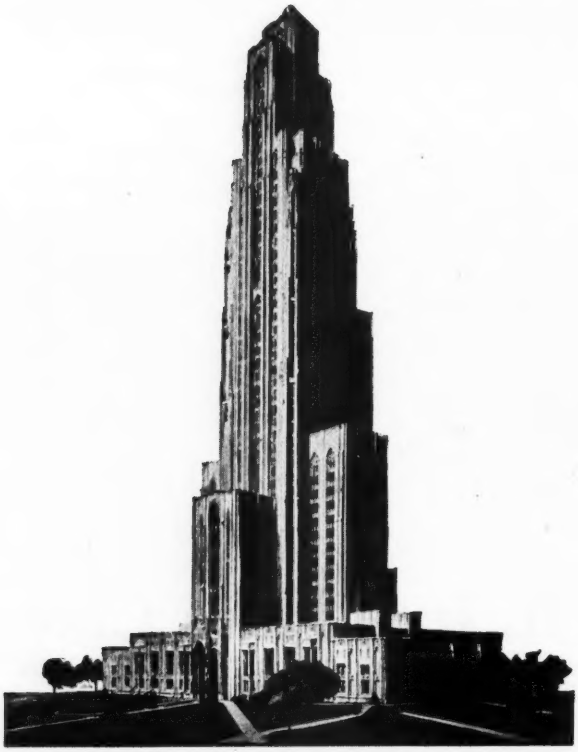

Architect's model of The Cathedral of Learning

Photograph by courtesy Scientific American

Sinking the great shafts to the bed rock

Rock drillers at work on a shaft

Drillers trimming tops of shafts

Seating the "highest" seat of learning

The Cathedral of Learning, University of Pittsburgh

FROM ground line to tower top six hundred and eighty feet high, the highest seat of learning in the United States. Twelve thousand students will ride up and down the fifty-two stories of this great tower in twelve elevators. The central tower is approximately ninety feet square and the wings are fifty-four feet wide and vary in length from forty to eighty feet.

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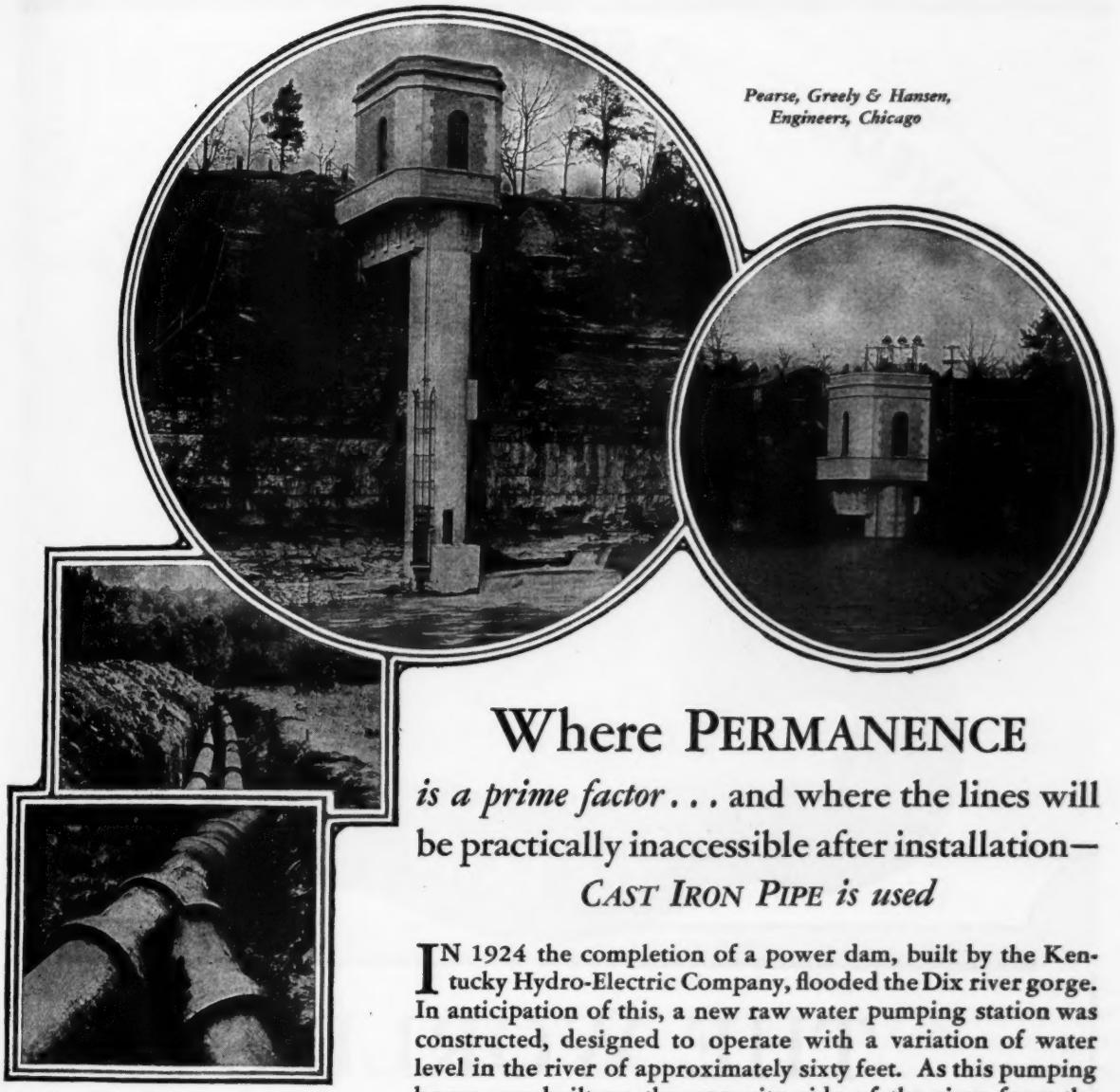
LUNDIE TIE PLATE



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One outstanding accomplishment was the decrease in the average consumption of fuel by both freight and passenger locomotives. Last year this factor of railroad efficiency broke all records, showing an improvement over 1922 of 20% in the freight service and nearly 15% in the passenger service. These reductions in the amount of fuel used per unit of traffic meant a direct saving of more than 3,500,000 tons.

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CANADIAN PACIFIC RAILWAY
BOSTON & ALBANY
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Railway Engineering and Maintenance

Volume 24 July, 1928 Number 7

A Way to Improve *Your* Paper

A FEW days ago we received a letter from a track foreman asking us to "please continue to print the Northern Division track bulletins like those on page 261 of the June issue. Also please publish some safety first articles applying to the maintenance of way department." A couple of days later we received another letter from a reader suggesting that we "devote more space to the question of the regularity or stability of employment in the maintenance of way department."

During the past month we have received a number of other equally valuable suggestions from readers of various ranks, from foremen to chief engineers. We welcome such letters, for they help us in selecting for *Railway Engineering and Maintenance* that information that is of the maximum interest and value to the man on the job. If, in reading this or succeeding issues, you do not therefore find all of the material that you need, write us about it and we will do our best to procure and publish it. It is only by such co-operation that we can edit your paper in the way that will interest and help you most. Your suggestions are welcomed.

An Unusual Pumping Plant

THE editors of *Railway Engineering and Maintenance* pride themselves on the practical nature of the material which they present in its columns. This being the case, we desire to anticipate a question which will no doubt be raised in the minds of some of our readers as to what practical benefit they can expect to gain by reading the article on page 287 which tells of a pumping plant that delivers water against a static head of 3,870 ft. The primary interest in this article, of course, lies largely in the very fact that it describes work which few other railway men will have occasion to carry out. It covers a project of so unusual a character that we are sure it will be widely read for this reason alone. It is a convincing demonstration that there is still romance in railroading.

Those engineers of water service who have known that the Union Pacific was studying the problem of supplying water to its resort on the north rim of the Grand Canyon from a supply far down in one of its branches, have naturally inferred that the water would be delivered through the agency of pumps at several different levels. That this plan was not adopted, and instead, a single-lift system was installed, is in itself a most extraordinary fact which is worthy of record.

Herein lies the real justification for this article. A publication such as *Railway Engineering and Maintenance* has a duty to its readers in presenting to them each month information which is of value to them in the routine conduct of their work. However, it has another responsibility in making a record of information relating to the unusual in such a form that it will be available to the engineer who is confronted with a like problem at any time. It is for this reason, and because of its intense technical interest, that we welcome the opportunity of presenting the article in this issue.

Camps an Aid to Efficiency

DURING the war many of the railways made marked improvements in the character of the camps that they provided for their track forces. They did this under compulsion, for labor was scarce and the men went to those roads which offered the most attractive quarters. When this emergency passed, some of the railways reverted in full or at least in part to their old practices. This retrogression has not been universal, however, for on not a few roads the camps have since been maintained to the standards then established and in some quarters the improvement undertaken at that time has been continued.

With the disappearance of a labor shortage the demand for better camps now rests on other grounds than necessity. Rather, it now reflects an appreciation of the fact that comfortable quarters can be justified on economic grounds—on the increased efficiency of a contented force of men. A well-maintained camp has been shown to reduce labor turnover with its attendant losses. It will also attract to a road a better class of men and increase its ability to select. For these reasons the provision of modern camp facilities deserves the same careful consideration of supervisory officers as is accorded a device that reduces the amount of labor required for a specific task. Both lower the cost of doing work.

The Sense of Proportion

ONE of the hardest tasks of a roadmaster or supervisor is to instill a sense of proportion in his track foremen on secondary lines or branches so that the track may be kept in a safe and otherwise satisfactory condition for the traffic it is called upon to carry, without wasting money in attempting to maintain it to a standard beyond that demanded by the character of the traffic. The ambitious foreman naturally takes a pride in his track and is tempted to improve it to the utmost of his ability with the means at hand, but on light traffic lines he is often apt to carry this to extremes unless he is closely supervised, and to find eventually that he has used up his allowance without having done some work which

is essential to safety, and which must be done, with the consequence that the allowance for the season is over-run.

Where the amount of money to maintain the track on a given section is small, it takes careful planning to spread it over the work to the best advantage and both the roadmaster and the foreman must not only plan the work but must see that the plan is followed. Much assistance in this matter can be given by the operating department in fixing speed limits on secondary lines, consistent with the traffic requirements. It has been said truly that speed acts as a microscope to magnify the imperfections in the track, and if speed can be controlled the problems of the maintenance of branch lines can be simplified to a great extent.

Seasoning Ties on the Right of Way

THE treatment of a tie with a preservative increases its first cost 25 cents or more, which added outlay yields no return whatever until after the normal life of the timber untreated has been reached, frequently 8 to 10 years. Yet, two-thirds of the ties used today are treated because of the recognition on the part of maintenance officers of the fact that the expenditure is warranted by the increase in life secured ultimately. Many of these same officers, however, not only condone but openly approve the practice of seasoning these ties in the weeds on the right-of-way to avoid the cost of transferring them to a properly prepared seasoning yard, although ample evidence is available to show that this transfer will pay an even greater return, measured in increased tie life, than treatment itself.

This anomaly indicates that railway men are not yet alive to the fact that proper seasoning of ties before treatment is just as important as propert treatment itself in securing the maximum life from ties. In this respect maintenance officers have much to learn from those engaged in the treatment of timber, for with a few notorious exceptions, the seasoning yards at the treating plants, both commercial and railroad, are kept scrupulously free of vegetation which is known to favor the infection of the timber. Yet, with ample knowledge available of the inevitable results of seasoning timber in rank vegetation, roads whose practices in the handling of their ties are otherwise above criticism, are leaving their timber to season on the right-of-way under conditions that are the very opposite of those that are considered so essential at the treating plants. Such a practice is inconsistent with the purpose of treatment itself. If it is economical to treat timber to protect it against decay after insertion in the track, it is at least equally important to protect it against decay during the period of its preparation for treatment.

Crystallization or Fatigue?

A LANGUAGE that is in use is a living thing and like things that are alive it grows and changes as times goes on. Some words go out of use, others are created and still others experience a change of meaning through use. Words, or particular uses of words, which were once considered slang, are often accepted later as thoroughly good form.

One common source for new words is the development of a new industry—witness the many words created by the development of the radio. So also there are many words now in common use which were brought into being by the railroads. Rail, tie and ballast all had other meanings before the railroads came. Occasionally, words are appropriated to serve other purposes where the new use differs so much from the old that the new application is clearly incorrect. For example, shortly after the railroads began to experience the first real trouble with battered rail ends, some track men referred to such rail ends as "laminated," a clearly incorrect use because laminated means "formed in layers or of thin sheets bound together."

Other faulty uses of words have resulted from a misunderstanding as to the true facts, which continue after investigation has disclosed the error. One of the most common examples of this is the use of the word "crystallized" to indicate the cause of a break in a piece of metal after long use. This use became common because it was once supposed that repeated stress resulted in a change of the metallic structure, producing crystals, when as a matter of fact metals have a crystalline structure and microscopic examination of specimens subjected to millions of repeated loads have failed to disclose any change in the crystalline structure of the metal to justify the conclusion that the metal had "crystallized." Rather the failures are due to progressive tearing of the metal which is characterized more properly as "progressive failure" or "fatigue" of the metal.

We are not in sympathy with any "highbrow" attitude with respect to the use of words. In general, the best word for any purpose is the one which is in most common use, but the employment of a word which expresses an incorrect statement is unfortunate.

The Roadway Program

DURING the first three months of 1928 the railways spent $128,428,000 for improvements and additions to their properties chargeable to capital account. This was $26,594,000 or 17 per cent less than was expended in the same period in 1927. But the significant point is that the reduction in expenditures for roadway and structures improvements was not in the same proportion, in fact, it totaled only $4,264,000, or 4.3 per cent. Furthermore, of the total expenditures made during the first three months of this year $95,412,000 or 74 per cent was spent by the roadway department.

These figures are of special interest to engineering and maintenance of way officers and to those making materials for use in these departments of railway servoce. In the first place, they illustrate the marked contrast between the trend of expenditures in the roadway and in other departments. When consideration is given to the decline in prices of materials and the increase in efficiency of labor, it is evident that the amount of work actually being done in the roadway department this year approximates that of 1927.

Again, of the total expenditures made for roadway facilities during these three months, those for heavier rail and for additional ballast, indicative of the more strictly maintenance work, showed actual increases of $1,346,000 or 16 per cent and of $382,000 or 25 per cent respectively, while the decreases occurred in the "additional track" and "shop and engine house" accounts, typical of the larger new construction projects.

Of equal interest is the increasingly large proportions of the total expenditure that the roads are devoting to roadway improvements, as compared with equipment. During the first three months of this year 74 per cent of the total amount spent went for roadway facilities, as compared with 63 per cent in the same period a year

ago and still smaller percentages in preceding periods. It is these expenditures that are, in large measure, making it possible to reduce expenditures for locomotives and cars, for with adequate yards and structures, stronger and better maintained track, etc., it is possible to operate heavier locomotives and longer trains at higher speeds and thereby increase the amount of transportation produced by each car and locomotive in service. This has been the record of the railways in recent years and there is no indication that the limit has yet been reached. It is apparent that 1928 is to be another roadway year in the same way that 1927, 1926 and 1925 have been before it.

Should Tie Plates Be Wider?

THE PRIMARY function of a tie plate is to protect the wood of the tie at the rail bearing against destruction by crushing and by wear. Failure of the wood by crushing occurs when the load imposed by the rail is not distributed over a sufficiently large area. All woods offer relatively small resistance to crushing across the grain. The strength of wood in compression perpendicular to the grain, as the load is applied to a tie, is only a small fraction of its strength when loaded endwise, as with a pile or a post in a trestle. Therefore to avoid crushing of the tie, the tie plate must be sufficiently large that the unit pressure on the tie will be within safe working limits. It is, therefore, possible to determine by calculation, with a reasonable degree of accuracy, the necessary size of tie plates to prevent crushing of the wood fibres for any given wheel loads and any kind of wood. Such calculations are, of course, subject to verification by actual experience with tie plates of different sizes in service.

A letter to the editor appearing on page 284 of this issue raises a question as to the width of the tie plate, calling attention to disadvantages of plates that are too narrow, regardless of the area provided. This brings up a point which would seem worthy of further study. It is obviously wasteful to provide tie plates wider than the ties on which they are to be placed. Therefore plates have been given a width equal to or slightly less than the width of bearing face of the ties used.

With the greater uniformity in the sizes of ties resulting from a strict adherence to the A. R. A. specification for ties, in which grades are based largely on the width of the bearing face, it should be possible to work to narrower margins between width of ties and width of tie plates than has been the practice heretofore. Incidentally, this offers a further argument for rigid conformity with specifications in purchasing ties.

The Safety Record an Index to Efficiency

THE Union Pacific has long maintained an enviable record in accident prevention. In a letter to the editor on page 284, attention is directed to a new record just made on this road that is especially interesting to maintenance of way men. On the Colorado division, which comprises nearly 900 miles of main and branch lines and employs an average maintenance of way force of more than 700 men, an entire year has elapsed without an accident requiring a man to absent himself from his work for a *single* day. The outstanding character of this record is indicated by the fact that these men worked more than 1,900,000 hours in the period in question and are still increasing this figure. So far as is known this record is without an equal.

Records such as these are not made by chance; rather they are attained only as a result of the most thorough training of the men in safe ways of doing their various tasks. It is only when safe methods become second nature to men that a record such as this is possible.

The accident record of a railway, a division or a gang is a reflection of the attitude of the officer in charge towards the safety movement. If he looks on the records of other roads with skepticism and scorn and ridicules their performances as fictitious, it is a safe assumption that the records of his own forces in this respect are not worthy of emulation. If, on the other hand, he accepts each new record as a goal toward which to work, his forces will reflect this attitude in an improvement in their performance. In other words, the control of accidents is primarily the responsibility of the supervising officer, whether he be the engineer maintenance of way, a supervisor or a foreman. That man who constantly keeps before his forces the necessity for care, who corrects dangerous practices immediately when he observes them and who analyzes each accident when it does occur to determine and remove the cause, is the one whose accidents will be few. On the other hand, the supervising officer who himself takes chances, who condones and ignores dangerous practices so long as the men do not get hurt, and who belittles safety propaganda and makes no effort to cooperate with the safety officer, will find his attitude reflected in his men, and accidents will continue to "happen" among them.

While the safety idea can be promoted from a sentimental standpoint, it does not need to rest on such a basis. It is an intensely practical problem and its results are measured just as directly in dollars and cents as any effort directed to an increase in efficiency. In fact, safety and efficiency are companions, for those characteristics which make for care in the conduct of work also, in the long run, make for production. It is almost the invariable rule that the force with the best accident record also stands near the head of the list in efficiency. A supervising officer's safety record is therefore an index of his efficiency as well.

Renewing Turntables

THE replacement of a 90-ft. turntable with one of 105 ft. by the forces of the Delaware & Hudson at Colonie, N. Y., in 2 hr. 33 min., as described on page 302, is a record worthy of note. It compares with an elapsed time of 2 hr. 45 min. required by the Kansas City Southern to replace a 90-ft. turntable with one of 110 ft. at Heavener, Okla., in 1927, and with what is probably the best record ever made, 1 hr. 45 min., by forces of the Southern Pacific at Roseburg, Ore., in 1924, in replacing a 70-ft. table with one of 100 ft.

Anyone who has had a part in or has witnessed a turntable replacement knows what a complex procedure is involved, and anyone at all familiar with railway operation can appreciate what it means to the mechanical and operating departments to have the use of a busy roundhouse interrupted for even an hour. To change turntables in the shortest possible time requires careful planning and thoroughly organized forces, in which each man must know what he is expected to do before the actual change is made.

It is not surprising, therefore, that railway officers who have been responsible for work of this kind have taken a pardonable pride in the records achieved, and that during the couse of the last eight years, *Railway Engineering and Maintenance* has published 10 articles describing the methods pursued in carrying out the expeditious renewal of turntables, all of these articles

having been contributed by men who had participated actively in the work.

A review of these articles shows that the time that enginehouses have been out of service by reason of changes in turntables has varied greatly. In one case this interval amounted to eight days, but even as long ago as seven years, a turntable on the Chicago, Milwaukee, St. Paul & Pacific at Marmarth, Mont., was replaced in 5½ hours. However, little is to be gained by a detailed comparison of such records, because it is unfair to compare the relative efficiency of forces on different roads solely or even largely on the basis of the time required to make turntable renewals. To replace a turntable in 3 hours costs more money than it does to do it in 10 hours if the work is done with equal efficiency and the conditions imposed are the same in each case, because to do the work more quickly requires the marshaling of more men and much more equipment. The greater expense is clearly justified in some cases, but it is not in others, the decision depending on the value to the using department of the time saved. This, of course, varies with the local conditions and also with the attitude of the mechanical and operating officers.

The time required to renew a turntable is influenced greatly also by the physical conditions imposed. One of the most potent sources of delay in such work has been the change required in the center foundation. Unless resort was had to a through type of table the new turntable has been deeper than the old one, necessitating not only a heavier center foundation than the old one, but also one with its bearing surface at a lower elevation. This has given rise to no end of trouble and delay that is now being avoided in many cases by the replacement of old turntables with new end-bearing tables of either the continuous or the twin-span type, which are as shallow if not shallower than the turntables replaced and impose no greater maximum load on the center, even in cases where the new table is of considerably greater length. This improvement in design has unquestionably been a contributing factor in reducing the time required for such renewal operations in the past two or three years.

What Our Readers Think

A Year Without an Accident

Omaha, Neb.

To the Editor:

You may be interested in knowing that in the period from June 11, 1927, to June 11, 1928, the track forces of the Colorado division of the Union Pacific completed a full year of work without an injury to an employee resulting in a single day's loss of time from duty. The Colorado division comprises 638 miles of main lines and 246 miles of branch lines, all of which is single track, except five miles leading out of the Denver terminal. The men who made this record include a division general roadmaster, six district roadmasters, 117 section gangs and from one to three extra gangs, an average of slightly over 700 men for the entire period. These employees worked a total of 1,900,200 man-hours in that period. They are still continuing their record and will shortly pass the two million man-hour mark; we are hopeful that they can maintain this record indefinitely.

Accidents to railway employees, as generally referred to in safety competitions, are considered those reportable to the Interstate Commerce Commission where more than three days' time is lost in the ten days following an accident. On the Union Pacific we include in our local contests any injury resulting in the loss of more than one shift or one day's time from the employee's usual occupation. I mention this so that it may be understood clearly what the Colorado division forces have accomplished in avoiding even one of these minor lost-time injuries. There are some who claim that such records are made possible through returning injured men to work when they are not able to perform their regular duties. The track employees of the Colorado division desire that it be made very clear that on the Union Pacific a man is not released for work by the surgeon or permitted to resume duty by his supervisor unless he is fully able to perform the ordinary duties of his occupation and does so.

During the period in which this record was established the usual program of track work was carried out, including rail renewal, ballasting, unloading and renewing ties, with all of the hazards of motor car operation as well as the seasonal hazards of weather, cold, storms, etc.

The number of man-hours accumulated by these employees during the year offers an adequate basis for a comparison of their performance with that of other groups of men engaged in similarly hazardous occupations. We are inclined to believe that this is a new national record although we are not at this time able to confirm this statement. We will, therefore, be glad to learn if any similar record has ever been made elsewhere.

G. H. Warfel,
Assistant to General Manager, Union Pacific System.

Are Tie Plates Wide Enough?

Chicago.

To the Editor:

To function properly a tie plate must become virtually a part of the tie and retain its position undisturbed by any rail action that takes place. Under these circumstances tie plates may be found to extend the life of ties by preventing abrasive action by the rail base.

In order to economize in the weight of plates it is the usual practice to use plates somewhat narrower than the ties. A plate of any size will soon settle into the fibers of the tie and thus forms a rectangular depression in the surface of the tie that holds water and causes continued and more excessive settling of the plate into the ties. In fact, inadequate plates are often found to afford less protection to the ties than if no plates were used at all.

It would seem, therefore, that if the full value of the tie plate is to be realized the plate should be made of sufficient width to insure drainage to one side of the tie plate bearing surface.

Maintenance Engineer.

No Accident for 300 Days

Jacksonville, Fla.

To the Editor:

The track forces on the Jacksonville Terminal Company are proud of the fact that there has not been an accident due to track negligence on this property for 325 days. They have established a further record of having worked 300 days without a reportable accident. During this period this terminal has handled 1,050 passenger cars and 2,165 freight cars per day. The terminal includes 400 switches and 47 miles of tracks.

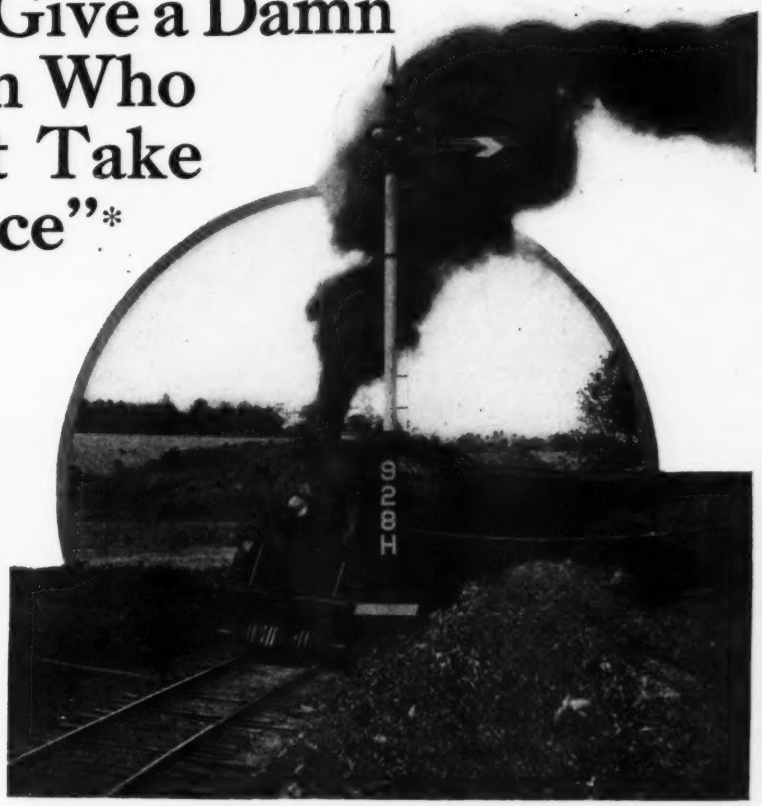
W. L. Choate,
Roadmaster, Jacksonville Terminal Company.

"I Wouldn't Give a Damn for a Man Who Wouldn't Take a Chance"*

An Attitude That Has Been Relegated to the Background in Our Maintenance Work by Safety Education

By L. B. ALLEN

Assistant to Vice-President, Chespeake & Ohio, Richmond, Va.



Getting to the Job Entails Definite Hazards

ABOUT twenty-five years ago a section foreman walked into the roadmaster's office and said: "I've quit. Give me my time." Several accidents had occurred on account of lever cars being hit by trains and the superintendent had put out the word that the next foreman who got his car hit would be fired. The roadmaster said, "And what's the matter wid ye now, Mike?" to which Mike replied, "Extra 324 hit my car on Hardin's curve and tore it all to hell." The roadmaster said: "Go wan back to worruk, I wouldn't give a damn fer a foreman who wouldn't take a chance with his lever car." That was the spirit of the times. There was no sympathy with safety measures among the men who did the work. They took it as a joke. Any man who couldn't keep out of trouble ought to get hurt. How could you get anything done if you didn't take a chance?

It was about that time that the Safety First movement dawned on the horizon and the faithful workers for accident prevention began their labor to save lives and prevent accidents. I was then a division engineer. My reaction to the move was pretty much like that of the roadmaster just mentioned. I went along with the movement in a half-hearted sort of way. It appeared to me then that every recommendation made by the safety inspectors meant more work and added expense for the maintenance of way department. I thought that 99 out of every 100 recommendations were referred to the division engineer to correct. I cannot just recall when I was converted, or what experience I had, or who preached the sermon, but I "hit the sawdust trail," joined the Safety church, became an evangelist and have since preached the gospel of safety at every opportunity.

Statistics show that the accident and fatal injury rates of maintenance of way employees are 8 or 10 per cent above the average for all employees. We know that there is a reason for this. We know a lot of reasons; every one who is interested in safety work wants to correct this condition; but how?

We know that for every effect there is a cause. The effect we have to deal with is too many accidents among maintenance of way employees. Among the numerous causes producing this effect, are two outstanding and recognized conditions. One is that the class of work performed and the conditions under which it is performed involve a greater risk, and the other is, that the class of labor used is less susceptible to the realization of the meaning of safety habits.

As to the kind of work, and the conditions under which it must be performed, we will take some common examples of every-day occurrence. First, the force must get to the place where it is going to work. The means of transportation is a motor car or a lever car. The starting point is frequently a place where train movements cannot be ascertained. The safety of movement to the job depends upon the judgment and care of the foreman in flagging the curves and keeping a close watch for approaching trains. The force arrives safely at the job about 99.9 per cent of the time. The hazards are there, but the careful foreman gets his men to the job day in and day out, sometimes year in and year out, with never an accident. The careless foreman gets his car hit and a lot of men hurt and the accident percentage jumps sky high.

The men arrive on the job, they lift the car off the track; again the pitfalls are before them, the strain of

*Abstracted from a paper presented before the Safety section, American Railway Association at Buffalo, N. Y., on May 16.

improper lifting and the chance of stumbling are more hazards for the careful foreman to watch and correct. Then comes the day's work. Trains are rushing by, a car door may be swinging, a rod sticking out, a piece of coal fall off, or a careless passenger may throw something out of a window.

Ties are to be installed in the interval between the passing of trains which, of course, is more or less limited and uncertain. The work must be done under pressure. As soon as the caboose or the rear car passes, the men must again be on the track digging, pulling and tugging to get in the tie and spike the rails before the next train comes. There is little time for a man doing this to look out for either himself or his fellow laborer. The foreman must do this for him and the careful foreman does. The same reasoning applies to almost every operation on the track, continuing through the day until the lever car is safe in the tool house, and the gang has left the right of way.

Even more hazards face carpenter and bridge gangs. Their chance to get in the clear is limited, the place they work is usually of meager footing and suspended high in the air. There is little room to dodge. They have the weak rope, the cracked scaffold board, the worn pulley block, the flying rivet, the swinging derrick chain, the snow, the ice and the elements to contend with. The foreman cannot be where he can watch each man.

A large per cent of the maintenance of way employees come under the classification of common labor. Among this class the turnover has been very great. It always will be great in the floating gangs organized for rail laying and heavy program ballast and tie renewals. This class of labor is careless; the men do not stay on the job long enough to acquire safety habits. They keep the foreman and the careful men in the gang busy looking out for them. I am glad to say, however, that this class of labor is diminishing rapidly. The stabilizing of forces is driving the careless and itinerant labor off the railroads. Handling the maintenance programs on an annual budget system and planning the year's work to keep reasonably uniform forces engaged throughout the year have been, and are now, greatly reducing the labor turnover and retaining in the organization experienced, steady, careful and reliable men.

Making Safety Second Nature

We have plenty of safety rules, we have volumes of safety literature, we have heads full of ideas, we know what we want to accomplish. All of this is worthless, however, if we cannot get the man who is flirting with the ambulance to cooperate.

A man will respect a rule to keep from losing his job, but he will not respect a rule to keep from losing his eye. How are we going to impress him with the fact that his eye is more important than his job?

Without sacrilege, let us compare safety with religion. As soon as a child of average parents is old enough to understand anything, he is told about God and the plan of salvation. The country is full of churches and Sunday schools. The boys and girls, the men and women, cannot possibly avoid contact with the teachings of Christianity. They soon learn the ten commandments, or some similar code of laws for the regulation of religious life. Their mothers, their fathers, and their forefathers, as a rule, believed in the laws of Christianity. They have the hereditary tendency, the early training and the constant contact of religion; consequently their conscious and their subconscious minds and their consciences work along the line of respecting the moral laws. The thought of deceiving, stealing, killing or the violation of any of the moral laws, immediately and coincidently registers on their conscience, which tells them whether it is right or wrong.

The only way to attain the goal of a non-accident existence is to live and think safety as people live and think law and religion. The time to start teaching safety is in youth. I know by experience that a child can, by constant effort, be taught to stop and look before he crosses a street. He may at times, in the exuberance of youth and the excitement of play, forget, but under ordinary circumstances and under almost every condition, he will automatically stop and look before he crosses the street, if it has been thoroughly impressed upon him. I have watched my children, unobserved by them, come rushing out of the yard, headed across the street toward the park, and as soon as the curbstone is reached, stop as though some one grabbed them. We have reasoned and spanked this into them from the time they could walk.

Can we not reason and spank safety into our employees and our future employees, by constantly keeping before them the importance and the rewards of living, thinking and acting safety, and the penalty of a maimed body, loss of earning capacity to himself or his fellow employee, if he transgresses the rules of safety. Let our safety agents be our preachers, our safety headquarters be our churches, our officers and foremen be our Sunday school teachers. Let us emulate the example of spreading the Christian religion, in spreading Safetyism.

Carrying the Message to Outlying Points

The Chesapeake and Ohio has recently put in service a safety instruction car. It is a modern steel coach fitted up with a lantern slide and moving picture machine. The car is self-contained in its heating, lighting and sleeping facilities. It can be set off at a blind siding near an extra track gang, an outlying station, or at any point where there is a side track, and be ready for action. The car is in charge of an experienced safety man, competent to give lectures and instructions on safety. An assistant operates the moving picture machine and is competent to take pictures of men in action, depicting the safe and unsafe methods of doing work. The car is supplied with numerous lantern slides and moving picture reels designed to impress safety on the minds of those who attend the lectures. The men who come to headquarters to safety meetings and who read the safety literature and bulletins are already in a way impressed with the safety idea. The men whom this car will reach are the men who do not ordinarily give safety a thought.

My theory of accident prevention in the maintenance of way department, and in every other department, is to spread the gospel of safety. Improve the physical conditions, remove the hazards, practice good housekeeping, and do everything that is within reason to furnish safe working conditions for the employees. This is no doubt being done to a greater or less degree by every railroad which has given the interest of its men and its own success the proper thought. Bulletins are issued, lectures are given, safety committees are appointed, but somehow and for some reason men continue to receive injuries by their own carelessness and the carelessness of others.

This thoughtlessness and carelessness needs curing and removing. It must be done through appeal to human intelligence. It is up to the safety preachers and the safety teachers to find a way to kindle the spark of intelligence that exists in even the dumbest laborer and to develop the intelligence of every employee to think, act and live according to the rules of safety.

The Rustic Architecture of the Power Plant Is Especially Appropriate for the Location and the Nature of the Materials Used

Grand Canyon Pumping Plant Lifts Water 3,870 Ft.

Supply Facilities for Union Pacific Development on North Rim Were Constructed Under Unusual Difficulties

A PUMPING plant, in which single-stage pumps lift water against a static head of 3,870 ft. by means of electric power developed by a hydro-electric plant using the same source of water supply, is the noteworthy feature of a project carried out by the Union Pacific for the development of tourist accommodations at Bright Angel Point on the north rim of the Grand canyon of the Colorado river in Arizona. But even more unique were the methods adopted to meet the obstacles imposed in construction work in a narrow precipitous tributary canyon involving a descent of 0.8 of a mile in altitude in a horizontal distance of 2 miles with individual cliffs presenting sheer drops of as much as 450 ft. Under these conditions the men in the working forces were subjected to great physical exertion merely to reach the various points of activity themselves, and materials and equipment could be delivered only by means of an elaborate cableway. Stone masonry construction with the use of rock quarried in the canyon proved cheaper than concrete, and sand for construction purposes could be made by crushing sandstone at less expense than it could be delivered from the nearest supply of natural sand.

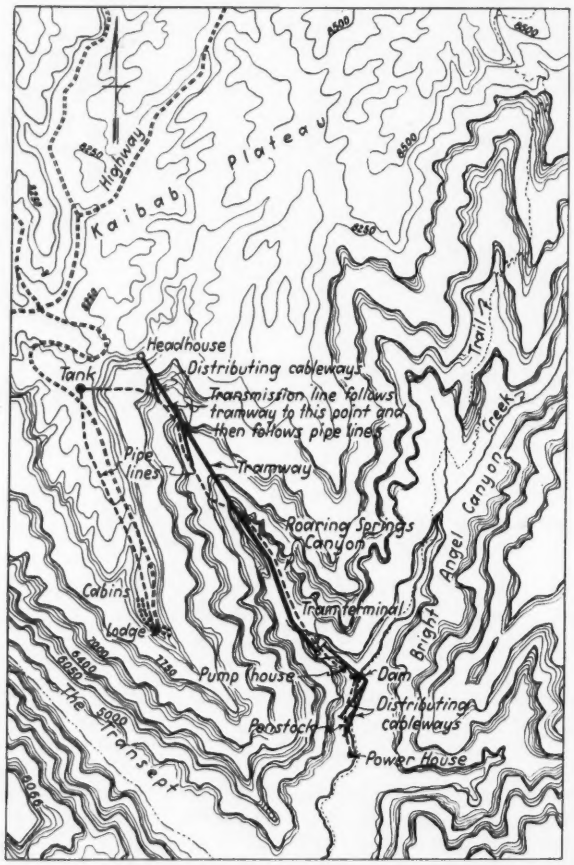
The facilities provided at Bright Angel Point are somewhat similar to those which the railroad has constructed at Zion and Bryce canyons and are located directly on the rim of the Grand canyon. With the exception of a few small springs there is no water on the rim of the canyon for many miles, and to secure a supply adequate for the demands of a project was the determining factor in the practicability of the development. The nearest supply of any consequence consists of three large springs known as Roaring springs, which flow out of a cliff on the east side of the Roaring Springs canyon, which is tributary to Bright Angel creek. These springs form a cataract about 300 ft. high, which is one of the scenic features of the canyon, but are at an elevation of some 3,800 ft. below Bright Angel Point.

An Adequate Supply of Water

In order to operate the extensive tourist facilities which were proposed, it was necessary to deliver water from Roaring springs to the rim of the canyon. Investigations made in January, 1927, developed that the springs had a minimum flow of 7½ cu. ft. per sec., or 4,860,000 gal. per 24 hr., and that the water available, over and above that required for use

on the rim, together with that from Bright Angel creek, would develop sufficient power to pump water to the rim and also furnish power for lighting purposes.

In the plant as built the water is impounded by a dam at the junction of the two creeks and is carried from this to a power house, a distance of 2,640 ft., in a penstock of 26-in. wood-stave pipe having a fall of 237 ft. In this power plant two 100-hp. impulse turbines operating at 450 r.p.m. are direct-connected to 81.25 kv.a. generators delivering 3-phase, 60-cycle, current at 2,300 volts. This current is delivered to the pump house 3,000 ft. up the canyon at 2,300 volts,

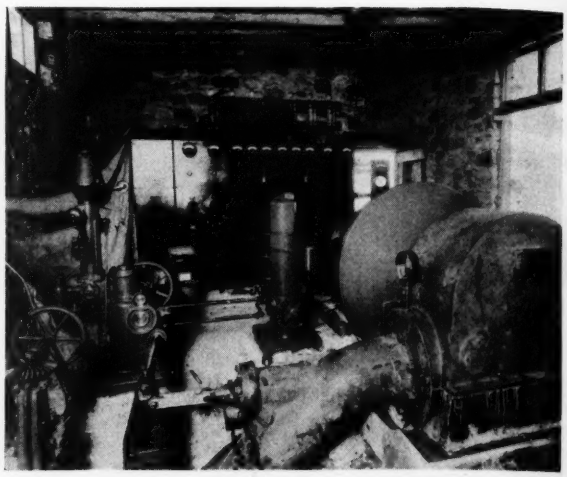


Contour Map of a Portion of the Canyon Showing the Location of the Water Service Facilities

but is stepped up to 4,600 volts for delivery to the rim where transformers are provided for stepping it down to 220 and 110 volts. The plant was designed to afford maximum flexibility of operation so that power could be furnished to the pumping plant and to the facilities on the rim independently.

The High-Pressure Pumping Plant

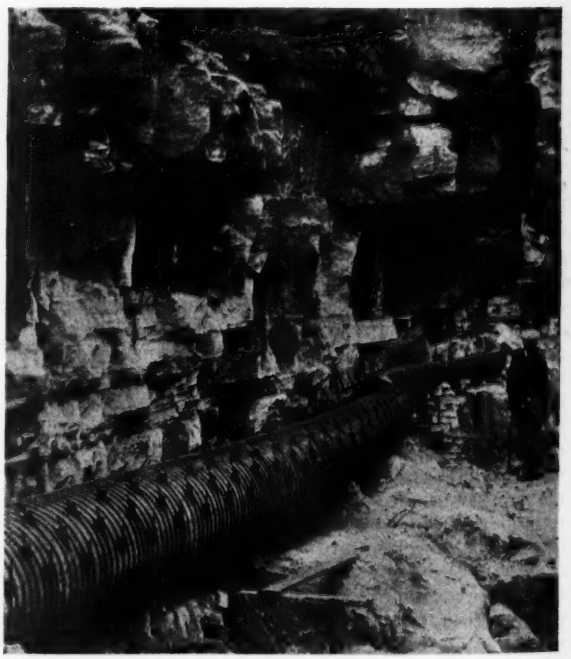
The pump house is equipped with two Logemann triplex pumps with a capacity of 30 gal. per min. each, driven by 50-hp. induction motors. The decision to adopt a pumping plant of the single-lift type, in spite of the enormous static head of 3,870 ft. imposed on the pumps and delivery pipe, was influenced by a number of considerations, primary among which is the inaccessibility of the pipe line, which made it impractical to construct intermediate pumping stations. Such stations, even if automatic,



A View of the Interior of the Power Plant

would have been expensive to operate on account of the difficulty of access for maintenance forces. Furthermore, during the early spring months, when the snow is melting, there is considerable danger from falling rocks, which would constitute a menace to stations located further up the canyon.

The single-lift system has been fully justified, as the operation of the pumps has demonstrated that it is an entirely practical plant, and while no accurate tests of the loss in friction head have been made, apparently it is less than assumed, as the amount of water delivered by the pumps is in excess of that determined in the computations. In order to avoid fluctuations in the flow and minimize vibration in the pipe line, it was decided to use triplex pumps which have a very uniform flow, and the assumptions in this respect have been verified in the operation of the plant. In order to eliminate any possibility of air in



The Penstock Was Located in a Narrow Gorge

the suction line, the intake sump was located so that the surface of the water in it is about four feet above the pump pistons.

The water is delivered through a 3½-in. pipe line to a 50,000-gal. tank on the rim. Three weights of pipe were used, standard wrought pipe in the upper portion, seamless pipe in the intermediate section and extra-heavy seamless pipe in the lower part of the line. The pipe line was covered wherever conditions permitted, but this was not possible everywhere because the line in some places is in a practically vertical position.

No expansion joints were introduced in the pipe line as they were deemed unnecessary due to the many sweeps and bends which were required by the topography of the country. In this connection, very few elbows were used in order to minimize friction head, bends being used wherever possible and extreme care was taken in locating the pipe anchors to allow for expansion and still avoid undue strain on the pipe.

As an aid to the operator, a high-pressure gage has been installed at the pump house which indicates the pressure in the pipe line at all times. A chart was also made up on the profile of the pipe line and graduated so as to show, by reference to the pressure registered on the gage, the approximate location of any serious break that might occur in the line. Communication between the pump house and the power house, as well as with the rim, is afforded by means of a telephone line.

Typical Views of the Cableway. The Central View Shows the Vertical Run of the 3½-in. Discharge Line Necessary to Surmount the Precipitous Ledge of the Blue Lime

It was the latter part of May before weather conditions permitted the work of locating the upper end of the pipe line to be started. A trail down Bright Angel canyon made it possible to get to Roaring springs from the north rim; but as the only short route for the pipe line was by way of the Roaring Springs canyon, it was also necessary to go down

through that canyon. This was difficult because some of the strata are very hard and resistant to erosion, several of the cliffs being practically vertical. This is particularly true of the stratum known as Coconino sandstone, which is about 400 ft. in thickness. The Supai formation, which consists of alternating beds of hard sandstone and soft shale, is about 1,200 ft. thick, the layers of sandstone forming the cliffs. The lower cliff, known as the Blue lime mentioned above, was found to be almost impossible of descent. However, about this time a fissure was discovered in the Blue lime through which men could descend to make a stadia survey down Roaring Springs canyon to the springs.

After the location of the pipe line was decided upon, it was necessary to devise means of distributing the pipe and transporting the machinery to the power house and pump house sites. Some consideration was given to an aerial cable-way from a point on the rim to a point on the opposite cliff above the springs. Such a cable-way would have required a 6,000-ft. span, and would have been about 2,000 ft. above the ground in some places. This plan was discarded on account of the difficulty of future maintenance of the pipe line, and it was finally decided to build a tramway from the rim down the Roaring Springs canyon, and locate the pipe line as nearly as possible under it. Stadia measurements were made for the location of the tram, the length of which was found to be about 9,800 ft. with a maximum span of 2,100 ft. Because the canyon is crooked and narrow, it was not possible to construct the tramway in a straight line, and angle stations were necessary at three different points.

Construction of the Tramway

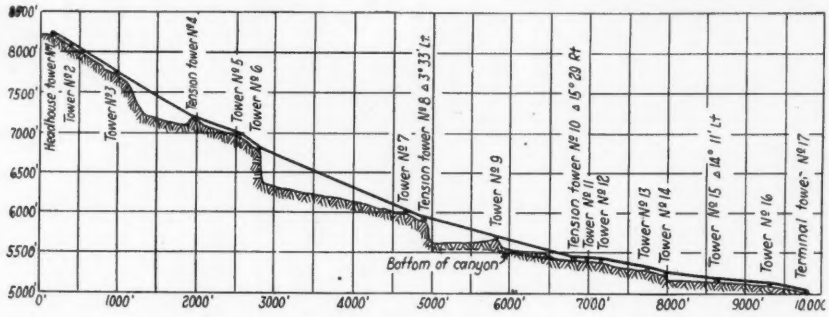
The tramway was of the single-track type with timber towers and cast saddles to carry the main cable, and rollers to guide the traction cable. Seventeen towers were constructed, including the head-house tower at the upper end and the terminal tower at the lower end. There were three tension towers of the anchorage-and-tension type, which were equipped with tramway rails, so that carriers could pass from one cable to the next without any difficulty. Where angle stations were located at tension towers, a continuous guard was fitted along the rail so that friction grips do not have to be released to permit loads to pass through the towers. Ten carriages were used, each provided with a top-opening friction grip to fit the traction rope. The tramway was designed to handle the heaviest loads, which were the pump bases, weighing 3,000 lb. each.

The work did not warrant the purhase of a large tramway engine for the head house, so an ordinary reversible hoisting engine was fitted up by putting a cast iron spool, made in two halves, on the drum to handle the endless cable. This gave very satisfactory service.

Tension towers were located at Stations 19+50, 49+00 and 68+50 from the head house, as shown on the profile. Each tower contained a movable weight box for anchoring the lower end of the cable. In the case of the first two tension towers, where the cable was on a steep incline, it was necessary to carry it through the towers and anchor the up-hill end to dead men in the ground, instead of anchoring on the up-hill end of the towers as is the usual practice. Intermediate towers were located wherever necessary to keep the loads from touching the ground. The maximum stress in the cable was taken as one-third of the ultimate strength and maintained uniform by the movable weight boxes at one end.

Had to Provide Temporary Cableway

In the erection, the traction cable was dragged out to the approximate location of the first tension tower, run through a sheave, anchored just beyond the tension tower location, the ends spliced, and then operated as an endless cable. Timbers for small A-frames, to be located at the edges of the cliffs and wherever necessary elsewhere to keep loads from dragging, were taken down on this cable and erected to serve as temporary supports for a temporary ¾-in. track cable. As soon as these towers were constructed, the temporary track cable was dragged down and set in saddles on these A-frames so that it could be used to handle timbers for the towers for the main cable to the various locations.



Profile of the Cableway

Permanent towers were then constructed and the permanent cables moved down on carriers and anchored at the up-hill end. "Come alongs" were put on the lower end in order to grip the cable, one end of a block and fall being hitched to the "come alongs" and the other to the weight box, so that the cable could be tightened up until the weight box swung free, thereby obtaining the proper stress and sag in the cable. This procedure was repeated in each cable section.

At the same time that the traction cable was carried forward, a ground circuit telephone line was constructed along the tram from the head house, and portable telephones were installed at each tension tower. By this means, all signals were transmitted to the operator in the head house, thus providing flexibility in the operation of the tram.

While the work was in progress it was necessary for the men to climb down into the canyon every morning and make the arduous climb out at night until the erection reached a point below the Blue

lime, where a camp could be located. As the traction cable was dragged ahead by hand over the cliff it often caught on points of rocks located in almost inaccessible places. As a consequence it was frequently necessary to lower men on ropes to release it.

Pipe Was Delivered Along the Line

As fast as the track cable was erected, pipe was delivered along the line at the different towers and from those points it was moved to the pipe line location by means of short distributing cableways, the loads moving by gravity. All the material for the 2,600 ft. of 26-in. wood-stave pipe line was moved from the end of the tram to the intake on a rig of this kind having a span of about 1,800 ft. From that point forward, it was delivered along the penstock line by means of other distributing cables. This was an advantageous method of handling this material as the penstock was located in a narrow gorge, and for a distance of about 1,000 ft. where the sides were vertical, it was necessary to blast a half tunnel section out of the rock to provide room for it.

All of the material, except the lumber, was hauled by truck from Cedar City, Utah, a distance of 195 miles. Most of this material was moved in during the summer, but in order to handle that material as well as men and supplies during the winter months, the railroad purchased two snow plows, one a wedge plow, the other a rotary, in order to keep the roads open.

Had to Make Sand for Construction Use

There is no sand in the canyon in the vicinity of the work, the nearest available supply being located about 75 miles away. To use sand from that source would have required a haul for that distance in trucks and laborious delivery down into the canyon on the tramway which was being employed to capacity handling pipe and other material. To avoid this, a method of crushing sand from sandstone was devised, the crusher consisting of two 1½-in. plates about 24 in. wide by 20 in. deep, set vertically, one stationary, the other movable, in an arrangement somewhat similar to the jaws in a Blake crusher. Power was furnished by an improvised water wheel made from an old cable reel mounted on an 8-in. timber shaft. All sand used in connection with the building of the power house, pump house, intakes and dams, all of which were constructed of stone masonry, was crushed in this manner. The sand was carried from the crusher to the various points of use by burros. The same circumstances are responsible for the use of rubble stone masonry in the dam, power house and pump house, with stone quarried in the canyon.

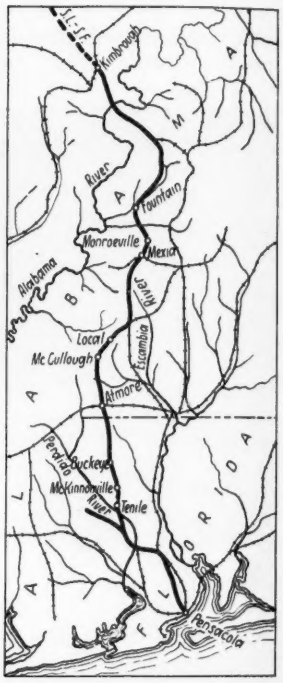
A Portion of the Penstock Showing the Rugged Character of the Location. In the Insert, the Dam and Spillway

All the work has been completed and the plant is in service. The machinery was installed under the supervision of a representative of the Allis-Chalmers Company, Milwaukee, Wis., from whom all of the power and pumping plant machinery was purchased. The wood-stave penstock line was constructed under the supervision of a representative of the Pacific Tank & Pipe Company. All of the work was done by railroad company forces and under the direction of the engineering department of the Union Pacific System.

TEN YEARS AGO—As a result of the present labor shortage the Chicago, Burlington & Quincy has organized 50 students of the University of Chicago into a special gang which will start for work at Sheridan, Wyoming, on June 17 to spend the summer in track work in that vicinity.—*Railway Age*, June 21, 1918.

Restoring a Broken-Down

Bankrupt Railway Property Acquired by the St. Louis-San Francisco Is Rebuilt for Main Line Service



This Pile Driver Drove as Many as 60 Piles per Day

Upper Left—One of the Many Ballasting Gangs Employed on the Work

At the Right—A Map of the Muscle Shoals, Birmingham & Pensacola

THE PRESENT high standard of construction now observed in the important main lines of American railroads is the result of a process of rebuilding and strengthening to meet the needs of an ever-increasing weight and density of traffic. In the vast majority of cases this process has been in the nature of a gradual development extending over many years. Occasionally, the change has been more rapid; new routings have resulted in marked increases in the volume of traffic within a relatively short time and with an attending need for stronger and better track. But it is not often that a line carrying almost no traffic at all and which, owing to lack of funds, has been allowed to fall into exceedingly poor condition, is suddenly given the status of an essential link in an important through route and must, in consequence, be almost completely rebuilt.

This is what has happened to what was, until about three years ago, an unimportant independent railway extending north from Pensacola, Fla., to Kimbrough, Ala., a distance of 142.5 miles. Incorporated in 1911 as the Gulf, Florida & Alabama, it was the purpose of the promoters to extend the line eventually to Jasper, Ala., a distance of 295 miles, where connections were to have been made with the Illinois Central and the St. Louis-San Francisco. It was placed in operation in January, 1913, and completed as far as Kimbrough in 1915, but financial difficulties were encountered from the very start and after a history of continuous operating deficits it went into the hands of receivers in May, 1919. It was reorganized as the Gulf, Pensacola & Northern in 1919 and again as the Muscle Shoals, Birmingham & Pensacola in 1922. But these reorganizations failed to improve the financial strength of the property. Lack of sufficient earnings made it impossible for a discouraged management to appropriate enough money for adequate maintenance, with the result that the entire line was reduced to a very poor physical condition, so poor, in fact, that passenger service was abandoned and the few freight trains which were required to handle the meager traffic could scarcely get over the road.

Possessed Certain Elements of Value

However, in spite of its low physical condition the line possessed several elements of value. Included among these were the ownership of a valuable right-of-way through the city of Pensacola to an excellent dock on Pensacola bay for the interchange of traffic between the railway and ocean-going ships. The road also owned a bridge across the Alabama river near the northern end of the line, built at a cost of about $175,000 and comprising a 290-ft. swing span across the navigable channel and two 145-ft. fixed spans, all built as riveted through trusses designed for E-50 loading; and with the exception of the 2,790-ft. of trestle approach, this was in excellent condition. Of even greater importance was the fact that the line lay in the direct path of a route extending from Amory, Miss., on the Birmingham-Memphis line of the St. Louis-San Francisco, by which that system proposed to obtain an outlet to tide-water on the Gulf coast. It was, therefore, in the light of these elements of value and with a full knowledge of the deteriorated physical condition that the Muscle Shoals, Birmingham & Pensacola was purchased on July 7, 1925, by the St. Louis-San Francisco which immediately prepared plans for a complete rehabilitation of the property at a cost in excess of $2,225,000. The work was undertaken concurrently with the construction of a new line 151 miles long extending from Aberdeen, Miss., to Kimbrough, Ala.

The physical characteristics of the Pensacola line are briefly as follows:

After traversing the flat highlands north of Pensacola between the Perdido and Escambia rivers for

Line to Serviceable Condition

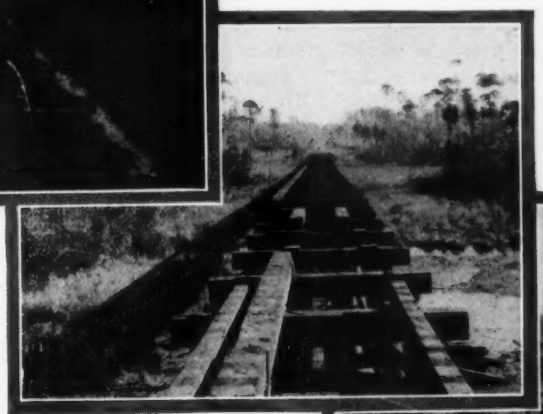
An Example of the Results Obtained—A View of the Rehabilitated Railroad near Monroeville, Ala.

a distance of 18 miles, the line turns abruptly to the west toward the valley of the Perdido and follows the general course of this stream and its tributaries in a northerly direction for a distance of 25 miles to reach the water shed between the Alabama and Escambia rivers. This water shed, which is occupied to Mexia, at Mile 90, is notably free from changes in elevation which offer any difficulties in railway construction; and while once covered with a heavy growth of timber, it is now largely cleared, although some portions of it have been overgrown with young trees. But at Mexia the character of the country changes abruptly, being broken by the valley of tributaries of the Alabama river with the result that the profile of the line comprises a succession of ascents and descents with considerable curvature for the remaining distance to Kimbrough.

Most of the line had been skillfully located. This is particularly true of the 52 miles in the difficult country between Mexia and Kimbrough, recent resurveys having demonstrated that the location could not be improved as to grade or curvature at any reasonable expenditure. However, the portion of the line between Mile 18 and Mile 70, comprising a railroad purchased from the Southern States Lumber Company in 1911, was of an entirely different character. Built purely as a plant facility, it was a typical "grass-root" railroad. Fortunately, most of it occupies flat country where lack of skill in location could do little harm, but in the more undulating territory the line was built with little regard for grades or curvature and many of the sags were crossed with short dips in the profile involving three and four per cent grades. Furthermore, such grading as was done was carried out in a most slip-shod manner. The fills were so narrow that the ends of the ties almost overhung the shoulders and the steep sides of the cuts were so close together that the ties could not be changed without jacking up the track. This condition is well illustrated in two of the photographs.

The investigation of the property made for the management of the St. Louis-San Francisco disclosed a remarkable state of inadequate maintenance. On

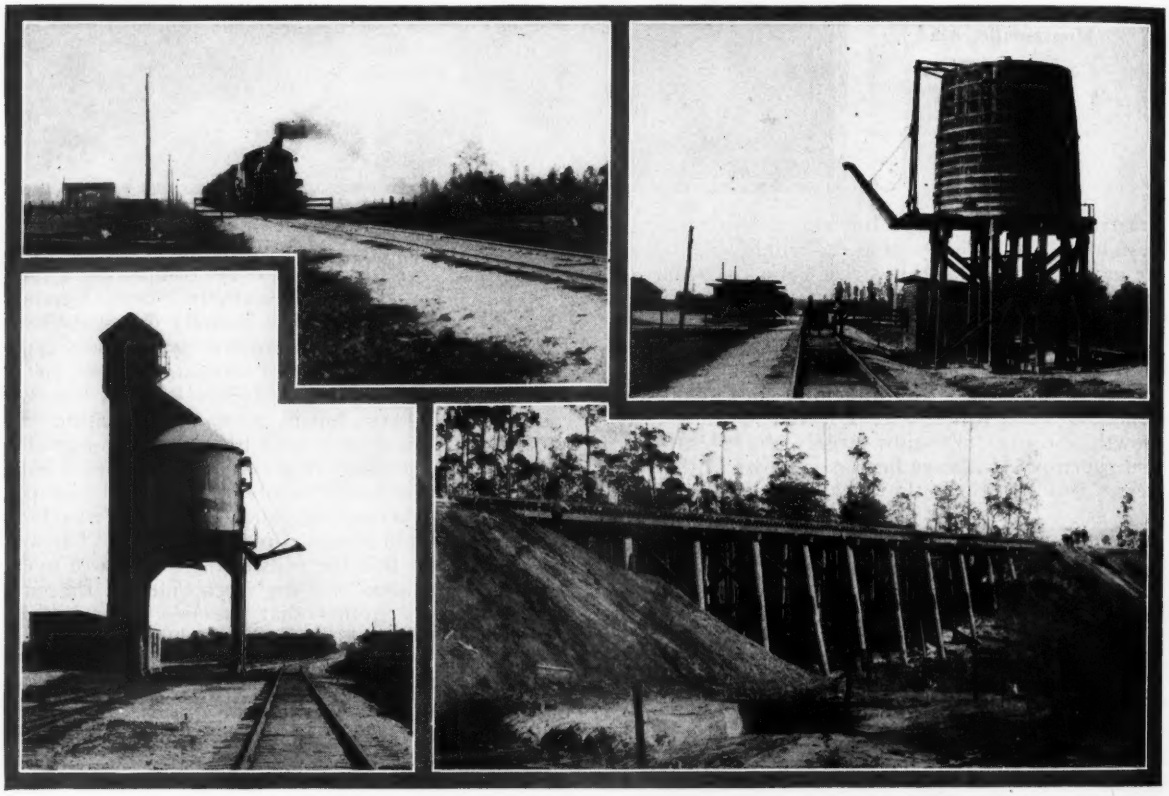
Above — Narrow Cut on Three Per Cent Grade Abandoned in Line Change



Below—An Abandoned Fill — Note Narrow Roadbed and Poor Condition of the Ties

At the Right—An Example of the Light Trestles That Were Replaced

the 52 miles comprising the old lumber railroad all but eight miles was still laid with the 50-lb. rail that was in the track when it was purchased from the original owners. Rail on the remaining portion of the line included 27 miles of 67-lb. rail, 15 miles of 70-lb. rail, 5 miles of 75-lb. rail and 52 miles of 80-lb. rail. All of the rail showed evidence of neglect. Most of the joints were held in place by but two bolts, many joint bars were broken and on a stretch of 80-lb. rail that had been laid with Weber joints, many of the wood filler blocks were missing. Many broken rails were held together with joint bars; in other cases, the more badly damaged portions had been cut out and replaced by "dutchmen." Furthermore, much of the rail, particularly of the lighter sections, was badly surface and line bent.



Typical Views on the Muscle Shoals, Birmingham & Pensacola

Much of the territory traversed favored light grades
New coaling station at Local, Ala.
The capacity of the water tanks ranged from 10,000 to 50,000 gal.
New trestle on line change near Buckeye, Fla.

Poor Tie Condition

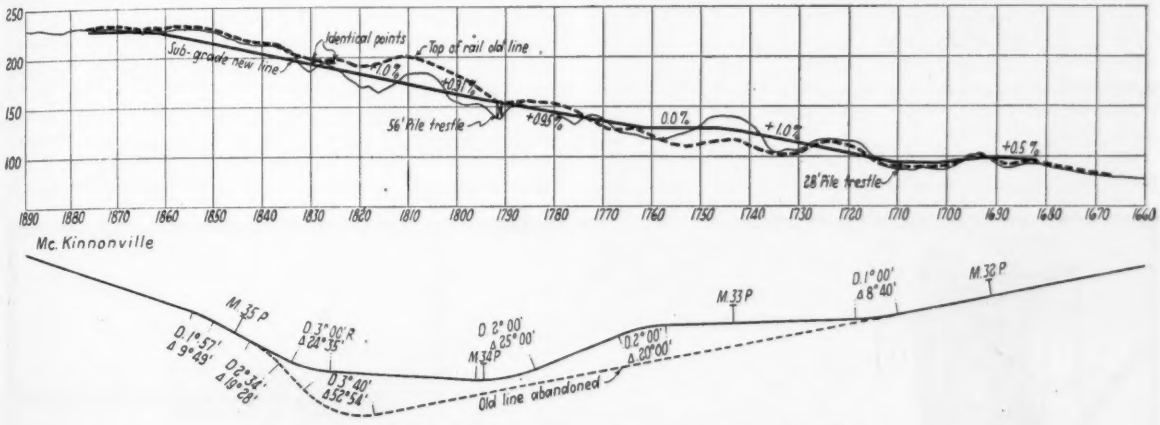
The tie condition can best be indicated by the fact that renewals carried on during the two years of the rebuilding program totaled 390,000 or an average of about 2,300 ties per mile of all tracks. In many panels the ties had to be renewed out of face. No other material than the native earth was employed for ballast on any portion of the line. The roadbed averaged 14 ft. wide, but was much narrower than this between Miles 18 and 70, as previously mentioned, and also on the embankment approaches to the Alabama River bridge.

The use of steel structures in bridge work on the line was limited to the Alabama River bridge and one girder span serving as a grade separation structure. All other bridge structures consisted of pile trestles of light construction, namely four-pile bents with 12-in. by 12-in. caps spaced 10 ft. center to center, with a deck consisting of one 12-in. by 12-in. stringer under each rail and 6-in. by 8-in. ties. The condition of these trestle bridges is evident by the fact that an almost complete renewal resulted in the salvage of only about 300 bridge ties. Bridge maintenance and renewal work had been carried on in a most slovenly manner. Instead of replacing bents requiring renewal it had been the practice to reinforce the structures by driving one pile outside of each stringer halfway between the existing bents to form a two-pile bent, the old bents being left in place. As a result, the waterways were badly obstructed. No effort had been made to maintain right-of-way fence, with the result that little of it was left.

Trackage in sidings and yards totaled only 26 miles. Except for one siding 2,000 ft. long, the passing tracks had capacities ranging from 15 to 20 cars, many of them with main track connections at one end only. The turnouts were equipped with No. 7 frogs. Water stations on the line were served by primitive pumping plants, primarily of steam power, three drawing water from wells and three from streams. The wooden tanks, with capacities ranging from 10,000 to 50,000 gal., were in a leaking and decayed condition. There were no coaling stations on the line. Except at Pensacola, where locomotives were coaled by a locomotive crane, it was necessary to load tenders by hand from coal cars on adjacent tracks.

The program for the rehabilitation of this line was a large one. It included 1,000,000 cu. yd. of grading

in the revision of grades between Mile 25 and Mile 70, the filling of 30 bridges and a large amount of bank widening; two line changes covering 6.05 miles of line and involving 176,000 cu. yd. of excavation; the renewal of 13,200 ft. of trestle; a complete ballasting program; an almost 100 per cent renewal of ties; the replacement of all of the 50, 67 and 70-lb. rail, with 75-lb. and 90-lb. rail; a complete refencing of the right-of-way; the construction of a new modern coaling station at Local and a new engine terminal, including coaling facilities, at Pensacola; and extensive repair and enlargement of the harbor facilities at Pensacola.



Map and Profile of Line Change Near McKinnonville, Fla.

Ran Lines and Levels

The first step in the program was to rerun lines and levels over the entire length of the line for the purpose of determining what changes of line and grade, primarily the latter, were desirable, and to afford effective control for lining and surfacing operations. The natural step to follow this procedure was the grading, but upon investigation, it was found that it would be unsafe to disturb any of the track until the ties had been renewed. Therefore, the tie renewal and bridge work was started first, in May, 1926, to be followed in June of the same year by the first grading operations and later by the surfacing and the rail renewals.

The replacing of ties was done partly by company forces and partly under contract and at one time as many as ten 35-man gangs were employed in this work. The renewals were so heavy that it was necessary to resurface the track in the dirt ballast, in order to keep it in a passable condition until the regular ballasting program could be carried out. The contractor made effective use of a Nordberg track shifter in the work of renewing ties and dirt surfacing.

All of the pile driving for the renewal of the trestles was done with a single pile driver outfit having a steam hammer. This was done by a company gang of 12 men. Before undertaking this work, however, it was necessary to reinforce the decks by an additional 12-in. by 12-in. stringer in each chord. The average length of piles used was 50 ft. but a few bridges required piles up to 70 ft. in length. The pile driving crew made rapid progress, driving as many as 60 piles per day to an average penetration of 15 ft.

Rapid Progress in Building New Decks

The pile driving outfit was followed by four company and four contract gangs which capped the bents and renewed the decks. These gangs averaged 10 men and a foreman each. They were able to make rapid progress because of the little interference from traffic, being compelled to close up to permit the passage of trains only about four times a day. The work was also expedited by the fact that little material was salvaged from the old decks, other than the new 12-in. by 12-in.

A New Engine Terminal and Car Repair Yard Were Built at Pensacola

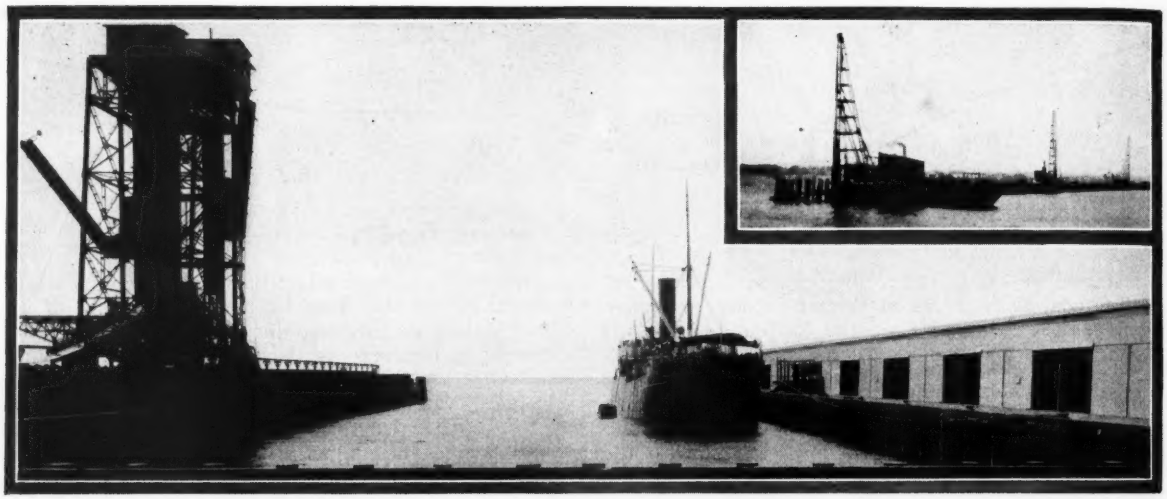
timbers which had been inserted for reinforcing of the stringers. At some of the bridges the work had to be delayed on account of the grade change operations as the track at some of the bridge sites was raised as much as 10 ft. Here the old bridge decks had to be blocked up two ft. at a time as the adjoining embankment was raised, using alternate tiers of caps and 12-in. by 12-in. stringers.

The new pile bridges consist of five-pile bents 14 ft. center to center with 14-in. by 14-in. caps, and three 8-in. by 16-in. stringers in each chord, with 6-in. by 8-in. by 9-ft. ties, laid flat, 12 in. center to center. The piles were obtained along the line but the sawed lumber was shipped in. All material is untreated. The bridge gangs were recruited locally with the exception of the pile-driver foreman.

As it was found that many of the trestles had been built merely to avoid grading at locations where carrier wings, for forming a widened roadbed in the cuts.

Just south of the Florida line there were two locations where it was found that excessive grades could be eliminated at less expense and with better alinement by changes of line than by attempting to revise the grades on the old alinement. This work, covering a distance of 6.05 miles and involving 176,000 cu. yd. of grading, was handled as a separate contract by Reid & Lowe, Birmingham, Ala. This work was done with a Marion-60 shovel and a ¾-yd. "whirley" shovel loading narrow-gage equipment, in addition to a 20-team outfit employed in making the lighter fills.

The line was given a minimum lift of six inches on gravel ballast from a pit at Mile 60 near McCullough, Ala. Owing to the irregular surface of the old roadbed the actual average depth of ballast under



The Railway Owns a Coal Dock and Wharf at Pensacola—Insert—Reconstruction of the Lumber Dock

waterway requirements were small, 30 of the bridges were filled and the necessary waterways provided in the form of boxes or pipe culverts. About 3,000 cu. yd. of concrete was used in box culverts, but in addition, a large number of Massey concrete pipes from 18 in. to 36 in. in diameter and Toncon metal corrugated pipes from 18 in. to 24 in. in diameter were installed. The metal pipes were used in fills up to 5 ft. and the concrete pipes in the higher fills. This concrete culvert work was done under contract by the Hedges-Weeks Construction Company, Springfield, Mo.

Grading Also Done by Contract

The grading for the filling of bridges and changes of grades was done by the Duplin Construction Company, Warsaw, N. C. Work on the first 20 miles out of Pensacola was done with teams from side borrow. But on the rest of the line the contractor employed five steam shovels, loading 12 to 20-yd. standard-gage cars, which were handled over the operated track. The larger cars were used in filling trestles and the smaller ones for bank widening. Most of the material was obtained in widening cuts or from borrow pits excavated in the sides of cuts. In general, the material was handled in 10-car trains. A Jordan ditcher was employed extensively, not only for spreading the material unloaded, but for dressing cuts and forming ditches and, with the use of the ties is considerably in excess of 6 in. and about 3,000 cu. yd. of ballast was used per mile, including the passing tracks. Two of the photographs show the appearance of the finished track. This work was done under contract by R. F. Carr, Memphis, Tenn., who employed an average of 160 men on the work. The first operation involved a gang of about 90 men, divided into three units, a skeletonizing and lining gang of 25 men, an unloading gang of 23 men, and a first-raise gang of 40 men. This crew was followed later by an outfit of 70 men divided equally between a surfacing gang and a finishing and dressing gang. Progress of as much as 10,000 ft. of track per day was attained in making the first raise, but it is to be remembered that there was little traffic to interrupt the work and this traffic was slow and did not call for any particular care in making the runoffs.

Rail Renewals Followed

Rail renewals were made by contract, the larger part by the firm which did the ballasting. The rail was unloaded by company forces which also loaded out the released rail. Although the contractor made some use of an improvised rail derrick, most of the work was done by hand with a gang of 50 men. The progress made was slow owing to its piecemeal character. The entire right-of-way was re-fenced under contract by A. Johnson, Jr., Chicago, with a gang of 50 men. All the posts are of creosoted pine.

In addition to an almost complete rebuilding of the track and structures on the line, the improvements included the building of a complete new engine terminal at Pensacola. This includes a six-stall engine house with 110-ft. stalls, 80-ft. engine pits and an 80-ft. turntable; a reinforced concrete coaling station of 100 tons capacity and a two-track cinder pit, both of which were furnished by the Ogle Construction Company, Chicago; a 100-ft. by 40-ft. frame mill shop for car repair service; a 20-ft. by 150-ft. store building; a locker building, 24 ft. by 67 ft. for the car repair men; and a repair yard of 9 tracks with capacities ranging from 11 to 21 cars each. A coaling station of the same type and capacity as the one erected at Pensacola was built at Local, Ala.

Extensive Work on the Docks

Extensive renewal and repair work was also carried out at the Pensacola water front facilities, primarily for the purpose of restoring portions of the structures destroyed or damaged during the hurricane of September, 1926, and to make good considerable deferred maintenance. These facilities comprise three piers, namely, Pier 1, a coal unloading plant; Pier 2, a covered wharf; and Pier 3 a single-track lumber dock. Pier 3 had been almost entirely destroyed and was rebuilt to a length of 900 ft. Pier 2 was lengthened 425 ft. and widened 27 ft. and now has a total length of 1,225 ft. with a warehouse 900 ft. long.

Repairs to the coal dock involved the renewal of the bulkhead at the head of the slip between Piers 1 and 2, the repair of some of the operating motors and the replacement of others, the renewal of the coal belt and the jacketing of the piles with concrete to protect them from marine borers. In addition, a fire protection system was provided by laying a 6-in. water main from the city water system to the docks and installing suitably located fire hydrants.

The rehabilitation of the Muscle Shoals, Birmingham & Pensacola has been under the general supervision of Col. F. G. Jonah, chief engineer of the St. Louis-San Francisco, assisted by H. B. Barry, principal assistant engineer. R. B. McKee, division engineer of the Muscle Shoals, Birmingham & Pensacola with headquarters at Pensacola, Fla., has been in direct charge of the reconstruction work.

Use Portable Crane to Wreck Building

AN UNUSUAL variation from ordinary uses of a portable crane was developed recently in connection with the wrecking of a building at Cleveland, Ohio. At the corner of Ontario and Eagle streets, the tracks for the southeast approach to the new Union terminal will occupy the location of a four-story building belonging to Armour & Company, and as the negotiations for the purchase of the property were delayed, it was necessary to remove the building as quickly as possible. Owing to the substantial construction of the building, which had a reinforced concrete frame and floors with brick exterior walls, progress in the wrecking was slow until the wrecking contractor hit upon the idea of using a crane with a 20-ft. boom manufactured by the Universal Crane Company, Cleveland, mounted on a White truck.

The crane was raised to the fourth story of this

How the Crane Was Placed on the Fourth Floor

building by running it up a ramp consisting of two 20-in. by 20-in. timbers 62 ft. long, which rested against the building at an angle of about 40 deg. with the ground. The crane was raised by fastening blocks at the top of the building and then running them down to two White trucks equipped with power winches. The rigging was done with great care to avoid accidents and it required four hours to move the crane up the incline and place it in position on the fourth floor.

One of the pictures shows the crane at work on the fourth story, with the clamshell bucket throwing

The Crane at Work Wrecking the Building

debris over the walls. Between times a 3,000-lb. skull cracker was attached to fall lines to smash the floor panels and knock over the walls. The plan of procedure was to have the crane destroy the floor on which it was standing, backing away until it was resting on a remaining panel in one corner. A ramp was then erected over which the crane could be lowered to the floor below to repeat the process.

The Essentials of a Labor Camp

The New York Central Takes Good Care of Men at Kings Bridge

Careful Supervision Has Important Place Among Requirements

High Grade Facilities Are an Essential for Feeding Men Properly—Above—a Part of the Camp Staff

AT THIS season of the year, when many railway officers are confronted with the problem of housing and feeding large forces of track laborers, a large labor camp on the New York Central will be of interest, particularly because of the unusually orderly and efficient manner in which it is operated and maintained. This camp which is known as the Kings Bridge labor camp, is located in the Bronx section of New York City, and while one of several camps maintained by the New York Central in this territory, it is of special interest because of certain features which have been introduced in an effort to provide satisfactory board and lodging for the men. A camp is essential to the operation of the New York Central in the vicinity of New York City, where local labor is not to be had, and where maintenance work is, therefore, dependent almost entirely upon such floating labor as can be obtained through the city.

Camp Is Well Located and Laid Out

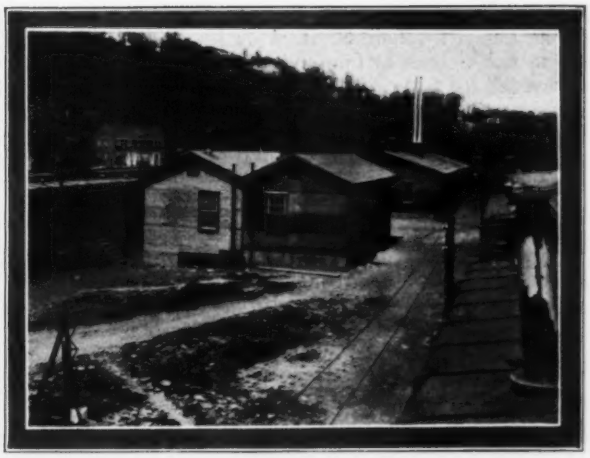
The Kings Bridge camp, which is equipped to handle as many as 240 men, is located between 500 and 1,000 ft. from the main line, at the west end of the New York Central's freight yard in the Bronx. The west end of this yard, which is an important inbound and outbound freight yard, affords an ideal location for the camp, in that it is centrally located on the territory worked by the men, and affords plenty of room, clean air, and little noise. This latter feature is due to the fact that practically all of the switching within the yard is done by electric locomotives.

The camp itself is of the semi-permanent type, consisting of a large kitchen and dining room building, a separate wash and toilet building, 30 bunk cars, and four additional cars used as a commissary, a storage car for blankets and bedding, a check car for housing any surplus baggage of the men, and a library and recreation car for the use of the men in their spare time. All of these various units of the camp are assembled together, the dining building and the wash building being located as centrally as possible so as to be equally convenient to all of the men.

The camp cars are located on tracks placed 25 ft. center to center, and the cars themselves are separated in each instance by a space of about 20 ft., this spacing being provided in order to afford adequate light and ventilation for each car, and more particularly to preclude the hazard of a serious fire. Between the tracks and surrounding the camp buildings, the area is covered with cinders which afford adequate drainage of the entire site under even the most adverse conditions.

The cars at the camp, with the exception of the library car, are all box cars specially adapted for camp use. Each car has eight sliding windows, two on the opposite sides of the car at each end; two hinged doors on opposite sides of the car at the center; and the entire interior of each car is provided with a wood lining to make it warmer during the winter and to give it a more finished appearance. While no attempt has been made to make the cars elaborate, they are kept well painted, particularly on the inside, where a two-color arrangement has been used on the side and end walls. The floors in the cars are those originally furnished with the cars, repaired and smoothed up where necessary, but unpainted.

From four to eight men are housed in each car. The bunks in the cars are of steel and are single



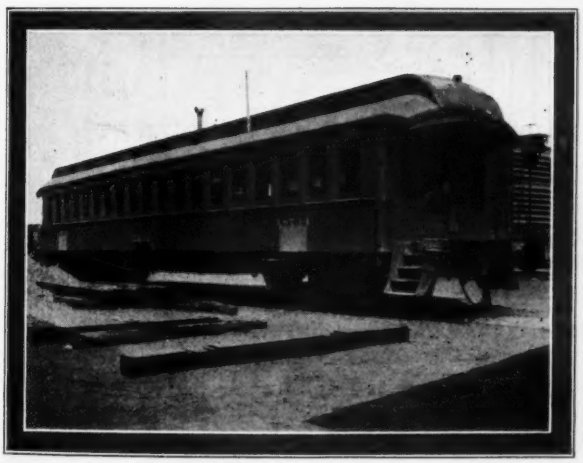
Above— Interior of the Wash House

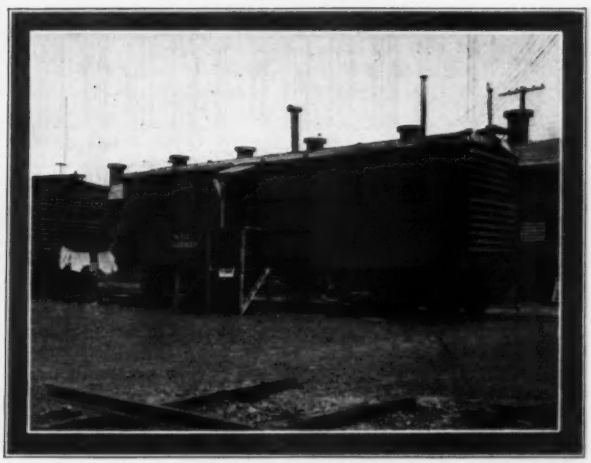
Center—A General View of the Camp

Below — An Unusual Camp Facility—a Library Car

Above — Part of the Camp Yard, the Wash House in Foreground with Mess Hall in the Rear

Below — One of the Bunk Cars, Showing High Grade Equipment Used





deck. They are located along the sides of the car toward each end, the space immediately beyond, at the ends of the car, being used as drape-covered clothes closets. All of the cars are equipped with electric lights, and heat is provided by small coal stoves located centrally between the doors in each car. Ventilation is obtained only through the windows, these being covered with netting during the summer.

In order to give an identity to the cars, other than numbers, each car has been assigned a special name which is affixed to it on a board name-plate. An idea of the character of the names assigned is gained from a few near the dining building, which are called, "Duck Inn," "Heaven," "Right Inn," and "Progressive." The commissary car is appropriately called the "Trading Post." These names were chosen and painted on the cars by the men themselves.

The kitchen and mess hall building at the camp is a one-story frame structure about 132 ft. long by 32 ft. wide, raised about two feet above the ground level on a suitable timber foundation. In order to protect the side boards and to give additional warmth during the winter, the entire exterior of the building, with the exception of the large number of windows provided, is covered with Ruberoid roll roofing, similar material being used also on the roof.

Within the building, the floor area is divided prin-

cipally into a large dining room, 90 ft. by 32 ft. in area, and a kitchen, 30 ft. wide by 32 ft. long. Off from the kitchen at one end, small compartments are provided for a cook's room, a storeroom and a built-in refrigerator. The interior of the building is unfinished except for a plaster-board ceiling, no attempt being made to cover the studding of the side walls. In spite of this, everything within the building appears neat and clean. Much of the credit for the appearance of the dining hall is due to the boarding company in charge, which, to give a more cheerful atmosphere to the surroundings, has provided attractive red crepe paper decorations over the windows and around the overhead electric lamp fixtures. A further pleasing touch to the appearance of the dining building is provided by flower boxes which are placed at many of the windows during the summer.

The equipment within the dining room consists essentially of long board tables covered with white oil cloth, and wooden benches. These are arranged along each side of the room with ample space between them and with a wide aisle down the center of the room. Within this center aisle are located several coal stoves for heating the building during the winter. All of the dishes used in the dining room are of heavy substantial white china, and the tableware is of plated metal. The kitchen, which is fitted with a large coal range for cooking purposes, is fully equipped with suitable utensils and fixtures for the preparation of food in a sanitary way.

Toilet Facilities in Separate Building

All of the lavatory facilities at the camp are housed in the lavatory building, mentioned previously, which is centrally located among the camp cars and about 50 ft. west of the kitchen and dining building. This building, which is 38 ft. long by 32 ft. wide, is similar in construction to the kitchen and dining building except that the entire floor area is covered with a waterproof galvanized iron covering.

Within this building, which is in reality two separate similar buildings joined together side by side, the floor area is divided into two equal parts by the side wall which is common to both buildings. These separated areas are joined, however, by a door at one end. Both sections are equipped alike, having 10 toilets along the intermediate wall, which are separated by wood panels, shower baths at the ends, and a long center wash basin with a galvanized metal lining, extending down through the center of the room. This washing basin is served by 10 sets of water taps on each side, from which hot and cold water can be obtained at any hour of the day. The hot water supply is furnished in each section of the building by a coal-fired water heater, and heat for each section is supplied by a small coal stove during the winter. Like all of the other units at the camp, the lavatory building is equipped with electric lights for night illumination.

Plenty of Wholesome Food

All of the meals served at the camp are arranged for and served under the direction of the boarding company, the charge to the men being at the rate of $1 a day, or $7 a week. This includes two hot meals, in the morning and at night, and a substantial noon lunch which is taken with the men to work. Contrary to the practice at some camps, all food is put on the table in bowls and on platters, and the men are permitted to eat as much as they care to. An idea of the character of meals served is gained from the following typical week-day menu:

Breakfast

Corn flakes and milk	Potatoes
Pork sausage	Coffee
Hot cakes and syrup	Bread, butter and jam

Supper

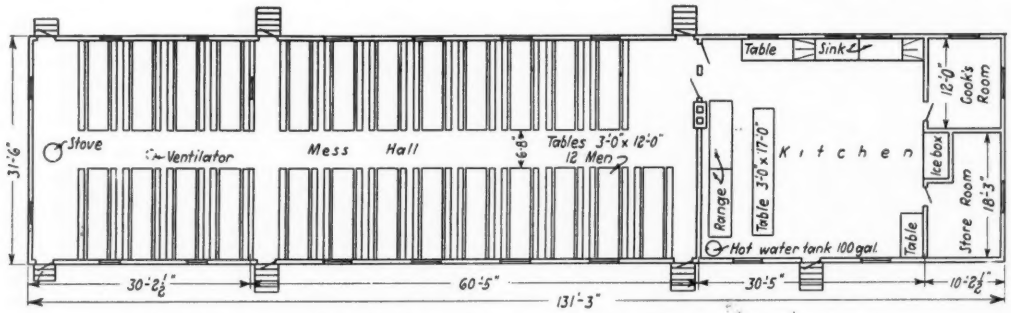
Soup	Stewed prunes
Roast pork	Cake
Sour kraut	Coffee
Potatoes	Bread and butter

On week-days the men invariably carry a lunch. This usually consists of three double-deck sandwiches of meat, cheese and jam, a piece of pie or cake, fresh fruit, and coffee. Sunday dinner is regularly a substantial meal similar to that served every evening.

Keep Camp in Good Condition

One of the outstanding features of the Kings Bridge camp is the clean and sanitary condition in which it is maintained. This is specifically required by the railroad and enforced by the boarding company. The camp is run by a camp manager with many years experience in handling labor camps, and the general welfare of the camp is in charge of a woman, who is the head of the boarding company.

With a force of nine men, consisting of a chef, a kitchen helper, three waiters, two yardmen and two watchmen, little is expected of the laborers other than that they mind their own business, make their own beds, and practice certain generally accepted sanitary rules. To the waiters, in their spare time between meals, is assigned the duty of keeping the dining room and kitchen clean in every respect. The yardmen have a number of miscellaneous duties which include keeping the camp site clean, sweeping the bunk cars, cleaning and mopping the toilet and wash building daily, tending the bunk car fires during the day when the men are away, and such odd jobs as removing waste and ashes, washing windows, etc.

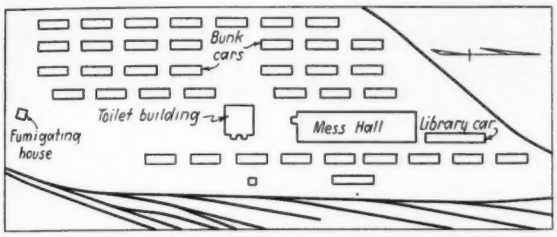


Plan of the Mess Hall and Kitchen Showing the Arrangement of Facilities

Garbage at the camp is removed daily by a city garbage collector.

The head yardman at the camp acts more or less as a foreman, directing the work of the other yardman. Every morning he inspects all of the bunk cars, opening them for airing, and notes whether every man has made up his bunk in a satisfactory manner. If any bunk is not made up satisfactorily, or if conditions about it indicate carelessness on the part of the man assigned to the bunk, the yardman takes the blankets and turns them in to the camp manager. In order to get his blankets again, a man must apply to the manager, where opportunity is afforded for such disciplinary measures as may be necessary.

Watchmen are maintained at the camp from 4 p. m. until 8 a. m., primarily to protect against fire and theft, but incidentally to see that order is maintained. Each watchman is on duty eight hours and is required to make the rounds of the entire camp



General Layout of the Kings Bridge Camp

every 30 min., punching time clocks at certain points. On unusually dark or stormy nights, the rounds of the camp are made as frequently as every 15 min. Supplementing this protection against the possibility of a serious fire, the dining room building is equipped with a two-inch fire line and a number of hand fire extinguishers, while water barrels are located at intervals among the bunk cars.

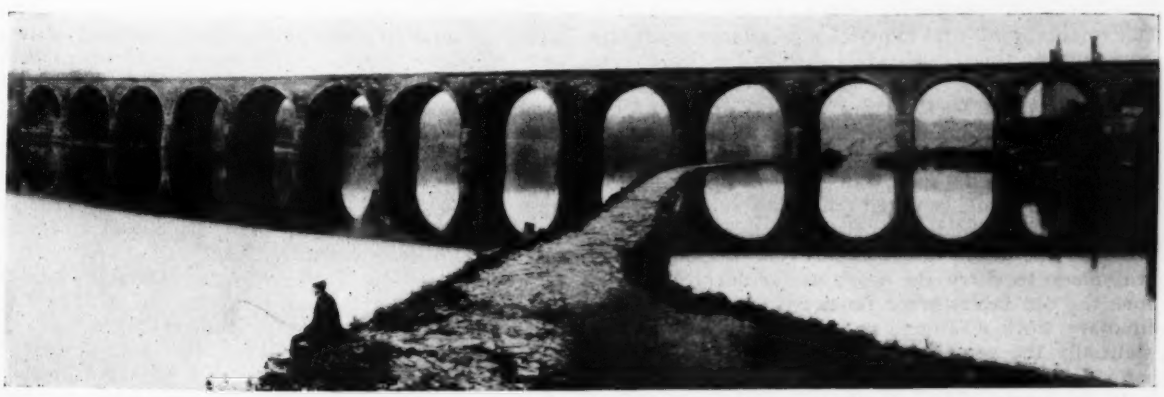
Kept in a Sanitary Condition

With the duties of the camp employees so specifically assigned, things in general are kept unusually sanitary and clean so that general overhauling and fumigating of the camp at frequent intervals is not necessary. A small fumigating house is maintained, however, where special articles can be fumigated if the necessity arises. All laundry at the camp is handled through the boarding company. Regularly, on certain days of the week, the men bring their soiled clothes to the camp manager, who sends them to a local laundry where the charges are reasonable. These charges are, of course, paid by the men themselves, through the boarding company.

While discipline is recognized as necessary at the camp and is meted out when the necessity arises, it is also recognized that one of the best ways to keep good order is to make the camp as home-like as possible, and to afford some form of activity for the men in their spare time. With this in mind, simple decorations are kept in the dining room, and flower boxes maintained at the windows and on some of the cars. To this same end, the railroad has provided a library and recreation car where the men can read, write letters, and play such games as cards and checkers. This particular car is an old day coach, electric lighted, with the regular green plush reversible seats, and equipped with a number of tables fitted rigidly into place between seats. The reading matter furnished in the car consists principally of back issues of a wide variety of papers and magazines, which are supplied by both the boarding company and the railroad. When not in use these publications are kept in the hand-luggage racks over the seats.

Another attempt to interest the men is made by the boarding company through the showing of moving pictures free, about once a month. These are presented in the dining hall, where one end has been fitted with a white wall to act as a screen. The dining hall is also used for other meetings from time to time, at some of which the subject of safety is discussed by supervisory officers of the railroad. A radio in the dining room also absorbs the interest of many of the men in their spare time. All of these various methods of interesting and amusing the men are maintained in spite of the fact that the camp is less than a mile from sections of the city which afford all classes of amusement and entertainment. This is done, however, because it is felt that it is better for all concerned to keep the men around the camp, and away from outside influences as much as possible.

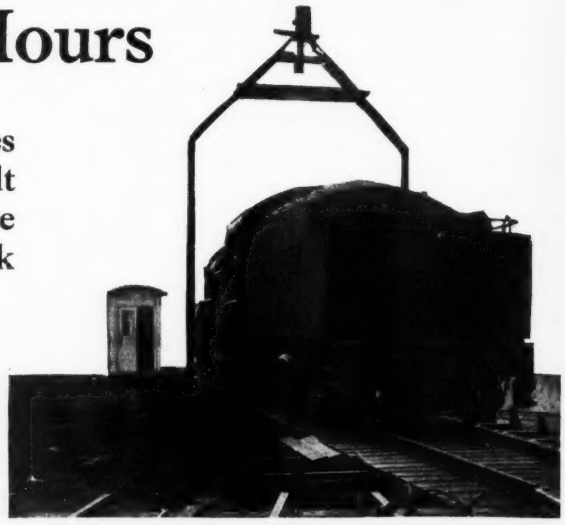
The particular camp described is maintained under the general supervision of N. W. McCallum, division engineer, on whose territory the camp is located. More direct supervision over the condition and affairs of the camp is maintained by O. C. Anderson, supervisor of track, who makes periodic inspections of the camp and the meals served, reporting conditions to the division engineer. Operation of the camp is in charge of Atwood's Employment Agency.



Old Stone Arch Bridge of the Pennsylvania Over the Raritan River at New Brunswick, N. J.

Delaware & Hudson Replaces Turntable in 2½ Hours

More Favorable Circumstances and Improved Methods Result in a Marked Saving in Time Compared with Similar Work Done During 1924 and 1926



The First Engine on the New Turntable

WHEN an old turntable is replaced with one of larger size in 2½ hr., it is evident that careful planning and supervision has been used. Such a record was made recently on the Delaware & Hudson, when on April 30, an old 90-ft. balanced-type table was replaced by a 105-ft. twin-span table in 2 hr. and 33 min. from the time the current was cut off from the old table until the new table had been turned one complete revolution under its own power.

The work in question was carried out at the large shop and engine terminal at Colonie, N. Y., about two miles from Albany, where the increasing size of the power handled required the installation of a longer turntable. The installation of the twin-span type of table marks the third renewal of this character which the D. & H. has made during the last five years, a fact which indicates the road's preference for this type of table, and also, that it has had considerable experience in recent years in devising ways to make turntable renewals most expeditiously.

The two other turntable renewal jobs referred to were at Oneonta, N. Y., where a 105-ft. twin-span table replaced a 75-ft. center-balance type table, and at Carbondale, Pa., where a similar twin-span table replaced a 90-ft. center-balance table. In the new table at Colonie, like the other two twin-span tables, the two halves of the table function as simple spans in distributing the dead and live loads to the center bearing and the circle rail. This particular table has four equalizing trucks, two on each side at the ends, which, together with the center, make it a five-point bearing table. All three tables were furnished by the American Bridge Company.

That existing conditions make a large difference in the amount of time required to renew a turntable, and furthermore, that experience is a large asset, are borne out by the record established in the three turntable renewal jobs. The first of these, that at Oneonta, which was carried out in January, 1924, required a total time of 7 hr. and 38 min.; the second installation, carried out at Carbondale in March, 1926, required 4 hr. and 4 min., while the third installation, or that at Colonie, required only 2 hr. and 33 min.

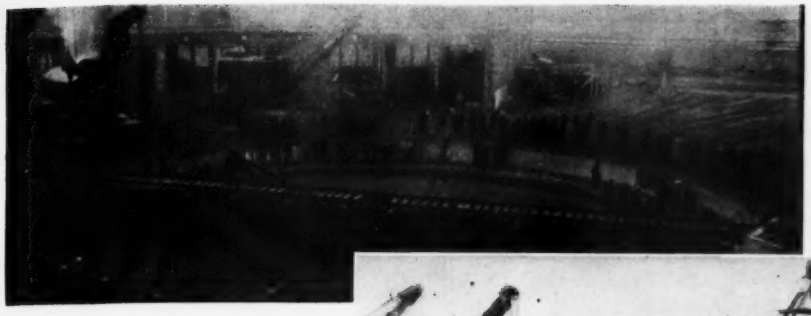
In an effort to reduce to the minimum interference with the operations at the engine houses, every effort was made to carry the work as far as possible before the old tables were renewed. All of this preliminary work was done under traffic, and was substantially the same in the case of all three renewal jobs.

In the main, this preliminary work consisted of excavating for, and constructing the new ring wall and circle track, cribbing up the enginehouse and approach tracks between the new and old ring walls, and the construction of the new electric power line. Only in the final work, which consisted of removing the old turntable, removing the temporary track cribbing and the installation of the new turntable, did the work at Colonie differ from that at Oneonta and Carbondale, and herein lies the reason for the large reduction in the time required on the Colonie job as compared with the other two installations. In the previous installations, on account of limited space, it was necessary to install one span of the turntables at a time, and then to bolt the two sections together, following which the ties and track rails could be laid. At Colonie, fortunately, there were enough enginehouse tracks and enough space adjacent to the turntable pit to permit the complete assembly of the table, together with its deck of ties and rails, prior to placing the table in position.

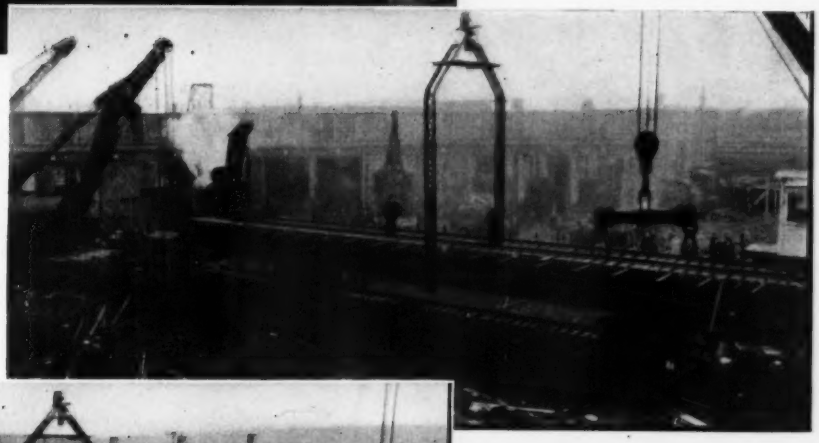
Forces and Equipment Were Well Organized

The equipment used in carrying out the work at Colonie consisted of a ditcher, a Burro crane, two wrecking cranes, one of 100 tons and the other of 160 tons capacity, a bridge-erecting crane of 25 tons capacity, and several gondola and flat cars. The principal auxiliary equipment used consisted of two sets of wheel trucks which were used as carriers for the assembled new turntable. With all of the preliminary work completed, and the time set for change-over, the above equipment was run into position, as indicated in the accompanying sketch, the new turntable trucks were placed and blocked in position in the pit of the new circle rail, the old table was spotted to receive the new table, and power to the old table was cut off.

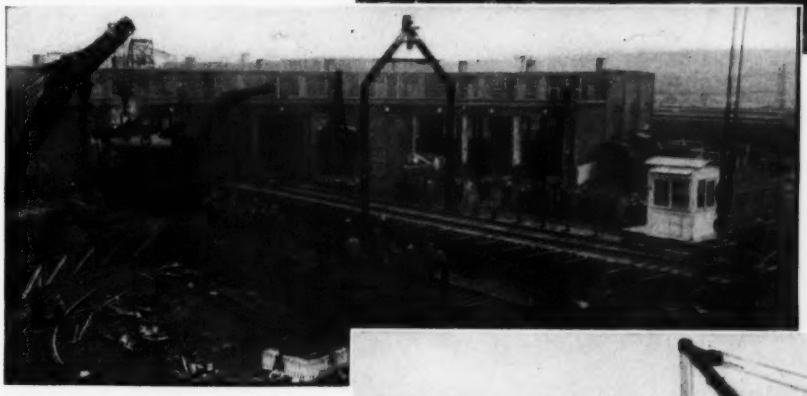
Up to this time traffic over the old table had not been interfered with, but when the old table was to be taken out of service, arrangements were made by the enginehouse forces to see that all needed locomotives in the house were removed and held outside. As soon as the power was cut off from the old table, which occurred at 7:44 a. m., the new table, which



The Roundhouse Clear and the Equipment in Position Ready to Replace the Old Turntable



The New Table Was Run Out Over the Old Table On Car Trucks and Centered in the Circle



The Bridge Derrick and the Wrecker Set the New Table On Blocking Alongside the Old Table

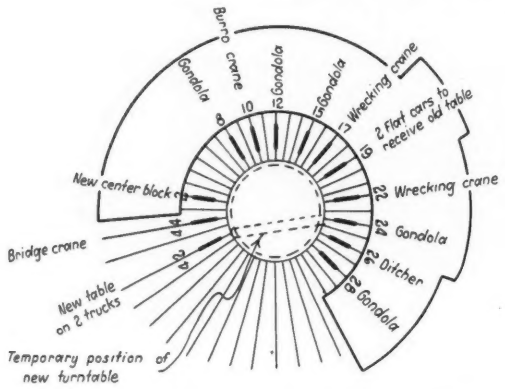
The Two Cranes Picked Up the Old Turntable and Passed It to Another, Which Set It On Cars

Preparing the New Center Block to Receive the New Center Bearing Prior to Setting the New Table

The Turntable Renewal Followed a Carefully Planned Program

was resting on the pair of car trucks on Track 42 as shown, was moved across and centered on the old table by a yard engine. When in this position it was picked up at one end by the bridge erecting crane on Track 44, and at the other end by the wrecking crane on Track 22 and placed spanning the pit on temporary blocking, parallel with and a few feet from the old table on the side away from the engine house.

While this latter work was going on, three section gangs removed the rails and deck from the old table, and also the old circle rail from the pit. All of this material was thrown into the pit and loaded promptly into gondola cars on Tracks 8, 12, 24 and 28 by the Burro crane on Track 10 and the ditcher on Track



How the Equipment Was Arranged Around the Turntable

26. These two units of equipment also tore down and loaded out all of the temporary cribbing which had supported the lead and engine house tracks between the new and old circle walls.

When the new table had been seated temporarily alongside the old table the same two cranes which had placed it, picked up the old table with its center and passed it sidewise to the other crane on Track 17, which secured a hitch at the center and loaded the table on two flat cars located adjacent to it on Track 19. With the old table out of the way, a ½-in. course of portland cement grout, one-to-one mix, was spread over the old center block to give it a smooth bearing surface, following which the bridge erecting crane, with its longer boom, spaced the new precast center block, and then, the new center bearing. Both of these new center pieces were accurately alined by the aid of two transits, the center bearing being anchored in place by bolts in holes prepared previously to receive them. In order to preclude any delay in this part of the work, all of the details of the anchorage had been prepared in advance, including the Babbitt material used to fill the bolt holes around the anchor bolts.

Do Clean-Up Work During Table Renewal

With the new center in place and anchored, the new turntable was again picked up by the wrecking crane on Track 22, and the bridge crane and placed in final position on the center and the new end trucks located on the new circle rail. As soon as the turntable was in position, the electrical forces, which had all preliminary work completed, started to make their final connections, and in five minutes the table was ready for operation. While all of this latter work of placing the new table was in progress, the track forces continued with the work of clearing the pit of all obstructions, so that almost simultaneous with the completion of the electrical connections, the pit was cleared, an engine was run out on the table, and the table turned under its own power.

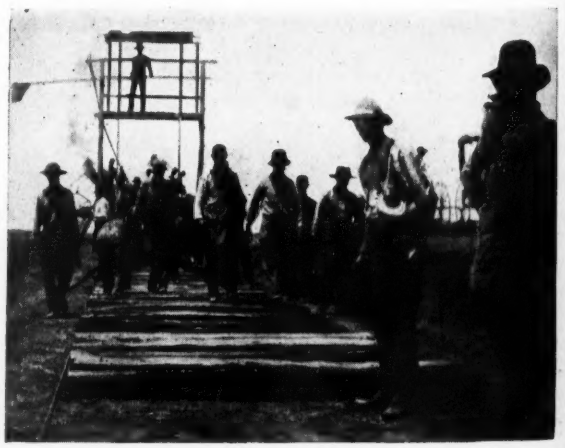
The progress of the work of installing the new table is shown in the following tabulation.

	Time A. M.	Time Elapsed
Power turned off old table	7:44	
New turntable picked up	8:10	
New turntable placed alongside old table	8:34	24 min.
Removal of old table started	8:34	
Old table completely removed	9:15	41 min.
½ in. cement mortar over old center bearing	8:50	
Completed	8:54	4 min.
Precast center block picked up	8:54	
Precast center block to elevation	9:04	10 min.
Center bearing to line and center	9:15	
Center bearing to line and center completed	9:26	11 min.
New turntable picked up and put in position	9:27	
New turntable in place	10:10	43 min.
All cribbing removed by	9:54	
Pit cleaned by	10:14	
First revolution of table started	10:15	
End of complete revolution	10:17	
Total elapsed time of installation		2 hrs. 31 min.
Total elapsed time to complete revolution		2 hrs. 33 min.

The total force handling the work at Colonie consisted of 98 men, including a bridge and building gang of 44 men, two wrecking crews of 7 men each, and three section gangs of approximately 10 men each. In addition, there was a bridge-crane crew of 8 men, one operator for the Burro crane, and an operator for the ditcher.

Reasons for the Record Made

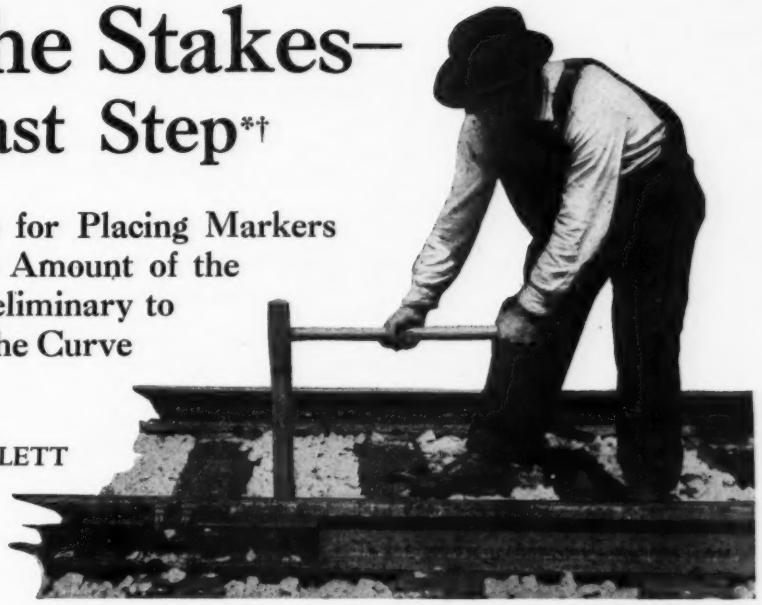
The fast time and systematic order with which the work at Colonie was carried out may be attributed to three principal reasons: First, adequate space was available so that the table could be completely assembled before placing; second, adequate time-and labor-saving equipment was available and effectively placed; and third, the efficient planning and organization of the men and equipment by J. C. Dorsey, division engineer, under whose immediate direction the installation was carried out. We are indebted to P. O. Ferris, assistant engineer maintenance of way, for the information contained in this article.



Laying Track on the Rock Island in the Early Days

Setting the Stakes—the Last Step*†

Practical Suggestions for Placing Markers to Indicate the Amount of the Throw Preliminary to Lining the Curve



By CHARLES H. BARTLETT

IN THE previous articles of this series the method of measuring the actual curve and the means of making detailed corrections in the alinement of the curve have been set forth. After these steps have been completed it is necessary, in every case, to set some sort of stakes or marks to indicate the location and amount of all corrections. It might be thought that it would be sufficient merely to start in and throw the curve at each string-lining station by the amount indicated on the slate; but such is not the case. It will be remembered that if any point on a curve is thrown either out or in, the adjacent points on either side move half as much in the opposite direction. Hence, after one station of a curve has been corrected, the original ordinate at the next one has been changed, and it is not sufficiently accurate to measure the correction from the new position of the rail.

Another argument in favor of setting stakes is that the actual work of re-alining the curve can be done at any time after the stakes have been set. It is quite apparent that every piece of track is subject to slight movements from day to day; but if stakes are set soon after the original measurements have been taken the amount of such movement is not enough to render the results untrustworthy. However, if no stakes are set, and the work of making the detailed corrections is allowed to be deferred until several months have elapsed, it is highly probable that the movement of the track will have been sufficient to render the results useless.

The Location of the Stakes

It is customary to set stakes opposite every string-lining station. There are some permissible exceptions to this rule, and these are discussed in further detail below. The particular place in which the mark is to be placed opposite the string-lining station is to some extent at the option of the individual. Stakes can be set at almost any convenient distance from the gage line (⅝ in. below the top of the ball of the rail) of the righ rail. However, of the different possible distances, only two have found much favor with track men. These are distances of one foot and of half the gage, respectively, from the correct or revised gage line of the high rail. Because of the fact that the setting of stakes for the center of the revised curve permits the roadmaster or supervisor to see at a glance the approximate distance that the track is to be shifted at each joint or station and because of the further fact that most railway engineering work uses the center line of track as the base line, and for numerous other reasons, the author is convinced that it is highly desirable to set all stakes so that they will represent the center line of the curve *after* it has been thrown.

In order to do this, it is necessary to compute the distance between the gage line of the actual curve before it is re-alined and the center line of the re-alined curve. This distance is a function of the throw at each string-lining station or joint of the curve.

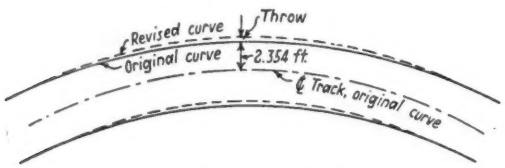
Standard gage or the distance between the gage line of the two running rails is 4 ft. 8½ in. Assuming for the time being that the gage is not widened on a curve it will then be necessary, in order to set a tack in a stake to represent the center line of the curve, to set the tack half-gage or 2 ft. 4¼ in. from the gage line of the high rail.

Now, if we assume that another stake is to be set to mark an outward throw of two inches, it is immediately obvious that the new stake must be set two inches nearer the gage line of the high rail; since, if the rail is to be shifted two inches out, the center will be shifted the same amount. Hence, in order to set a stake indicating an outward throw of two inches, the tack in the stake must be set a distance from the gage line of the high rail equal to half-gage *less* two inches, or 2 ft. 2¼ in. Conversely, if the throw is in, or toward the center of the curve, the tack will have to be set two

*This is the last of a series of six articles on the string lining of curves, describing the manner in which the line can be corrected by track men wthout the use of instruments other than a piece of string and an ordinary rule. The first article of this series, which appeared in the January issue, page 4, presented the merits of this practice in contrast with the use of a transit. The second article, which was published in the February issue, page 62, described the method of taking the measurements. The third article which appeared in the April issue, page 168, presented the basic principles underlying this method of determining curve alinement. The fourth article which appeared in the May issue, page 212, and the fifth article, which appeared in the June issue, page 258, described the method of selecting revised ordinates for a curve, to give the minimum throw.

inches *farther* from the gage line of the high rail, or 2 ft. 6¼ in.

Therefore, for every inch of throw in the outward direction, the stake for the revised curve will move one inch nearer than half-gage to the gage line of the high rail of the actual curve; and for every inch throw in an inward direction, the stake will move an inch farther than the half-gage. The rule is thus formulated that the center of the revised curve is distant from the gage



The Tack Distance

The tack distance for the string-lining stake is the distance between the gage line of the high rail before re-alining and the center line of the revised curve after re-alining.

line of the high rail of the actual or original curve an amount equal to one-half the gage *minus* the throw. The minus sign takes care of the sign of the throw; if the sign is plus (out), the distance will be less; but if the sign is negative, the minus sign changes it to a plus, thus adding the throw to the half-gage distance.

If we use half-throws instead of throws, the above rule should be changed to read: The center of the revised curve is distant from the gage line of the high rail of the original curve by an amount equal to one-half the gage minus twice the half-throw. Reducing half-gage to inches, we have:

Tack distance equals 28¼ in. minus twice the half-throw.

Tables showing the tack distances for different half-throws can be made very simply. It is usually more convenient to make these tables to show feet and decimals of a foot. In order to do this, it is necessary to reduce the 28¼ in. to feet, and reduce the half-throws in eighths or tenths of inches (whichever is being used) to feet. In order to illustrate the method, the author has done this for half-throws in tenths of inches. (Note 28¼ in. equals 2.354 ft.)

The half-throws, as obtained by the methods outlined in the preceding articles of this series, are in tenths of an inch. A half-throw of 0.1 in. means a full throw of 0.2 in. Reduced to feet, this is 2/120 or 1/60 of a foot. Each unit of half-throw, then, means that the stake is set 1/60 of a foot farther or nearer to the gage line of the original track. If we denote the half-throw in tenths of an inch by F (as in the notation used thus far), we have the relation that the distance of the tack in the stake from the gage line of the high rail on the actual unlined curve if given by

$$\text{Distance} = d = 2.354 - \frac{F}{60}$$

The author has constructed, for use in the field, table giving values of this distance, d, as computed from the above formula, for each value of the half-throw from +1 to +149, and also from —1 to —149. These tables are given herewith.

Such tables are easily constructed by differences. Thus, the difference between any two tack distances for a unit difference in throw is 1/60 of a foot, as explained above. This equals 0.1666666 ft. By subtracting 0.016 from one value, 0.017 from the next and making a correction opposite every fourth value (that is, employing the values in the order, 0.017, 0.016, 0.017, 0.017, etc.) we are enabled to write down these values very quickly. Again, every time the half-throw reaches a multiple of 6, the track distance increases or decreases, as the case may be, by 0.1 ft., so that after having computed the first six values of the tack distances for throws out and throws in, the remainder of the table can be constructed simply by adding or subtracting 0.1 ft., and using the remainder of the figures as they were in the first six values. Such a table will be found of immense value to any one who lines more than one curve, inasmuch as the savings in time and labor in computing the tack distances are tremendous.

Table Giving Distance in Feet of Tack From High Rail for Half-Throws in (—) in Tenths of Inches

0	0	1	2	3	4	5	6	7	8	9
0	2.354	2.371	2.387	2.404	2.421	2.437	2.454	2.471	2.487	2.504
1	2.521	2.537	2.554	2.571	2.587	2.604	2.621	2.637	2.654	2.671
2	2.687	2.704	2.721	2.737	2.754	2.771	2.787	2.804	2.821	2.837
3	2.854	2.871	2.887	2.904	2.921	2.937	2.954	2.971	2.987	3.004
4	3.021	3.037	3.054	3.071	3.087	3.104	3.121	3.137	3.154	3.171
5	3.187	3.204	3.221	3.237	3.254	3.271	3.287	3.304	3.321	3.337
6	3,354	3.371	3.387	3.404	3.421	3.437	3.454	3.471	3.487	3.504
7	3.521	3.537	3.554	3.571	3.587	3.604	3.621	3.637	3.654	3.671
8	3.687	3.704	3.721	3.737	3.754	3.771	3.787	3.804	3.821	3.837
9	3.854	3.871	3.887	3.904	3.921	3.937	3.954	3.971	3.987	4.004
10	4.021	4.037	4.054	4.071	4.087	4.104	4.121	4.137	4.154	4.171
11	4.187	4.204	4.221	4.237	4.254	4.271	4.287	4.304	4.321	4.337
12	4.354	4.371	4.387	4.404	4.421	4.437	4.454	4.471	4.487	4.504
13	4.521	4.537	4.554	4.571	4.587	4.604	4.621	4.637	4.654	4.671
14	4.687	4.704	4.721	4.737	4.754	4.771	4.787	4.804	4.821	4.837

To use this table read the distance of the tack from the gage line of the high rail in feet and thousandths of feet opposite the proper tens unit in the vertical column at the extreme left of the page and under the unit number across the top of the page. Thus 44, or a half-throw of 4.4 inches *in*, corresponds to a tack distance of 3.087, which is read on the horizontal line opposite the figure 4 and under the vertical column headed by the the figure 4.

Table Giving Distance in Feet of Tack From High Rail for Half-Throws Out (—) in Tenths of Inches

0	0	1	2	3	4	5	6	7	8	9
0	2.354	2.337	2.321	2.304	2.287	2.271	2.254	2.237	2.221	2.204
1	2.187	2.171	2.154	2.137	2.121	2.104	2.087	2.071	2.054	2.037
2	2.021	2.004	1.987	1.971	1.954	1.937	1.921	1.904	1.887	1.871
3	1.854	1.837	1.821	1.804	1.787	1.771	1.754	1.737	1.721	1.704
4	1.687	1.671	1.654	1.637	1.621	1.604	1.587	1.571	1.554	1.537
5	1.521	1.504	1.487	1.471	1.454	1.437	1.421	1.404	1.387	1.371
6	1.354	1.337	1.321	1.304	1.287	1.271	1.254	1.237	1.221	1.204
7	1.187	1.171	1.154	1.137	1.121	1.104	1.087	1.071	1.054	1.037
8	1.021	1.004	0.987	0.971	0.954	0.937	0.921	0.904	0.887	0.871
9	0.854	0.837	0.821	0.804	0.787	0.771	0.754	0.737	0.721	0.704
10	0.687	0.671	0.654	0.637	0.621	0.604	0.587	0.571	0.554	0.537
11	0.521	0.504	0.487	0.471	0.454	0.437	0.421	0.404	0.387	0.371
12	0.354	0.337	0.321	0.304	0.287	0.271	0.254	0.237	0.221	0.204
13	0.187	0.171	0.154	0.137	0.121	0.104	0.087	0.071	0.054	0.037
14	0.021	0.004	0.012	0.029	0.046	0.063	0.079	0.096	0.112	0.129

To use this table, read the distance of the tack from the gage line of the high rail in feet and thousandths of feet opposite the proper tens unit in the vertical column at the extreme left of the page and under the unit number across the top of the page. Thus 44, or a half throw of 4.4 inches *out*, corresponds to a tack distance of 1.621, which is read on the horizontal line opposite the figure 4 and under the vertical column headed by the figure 4.

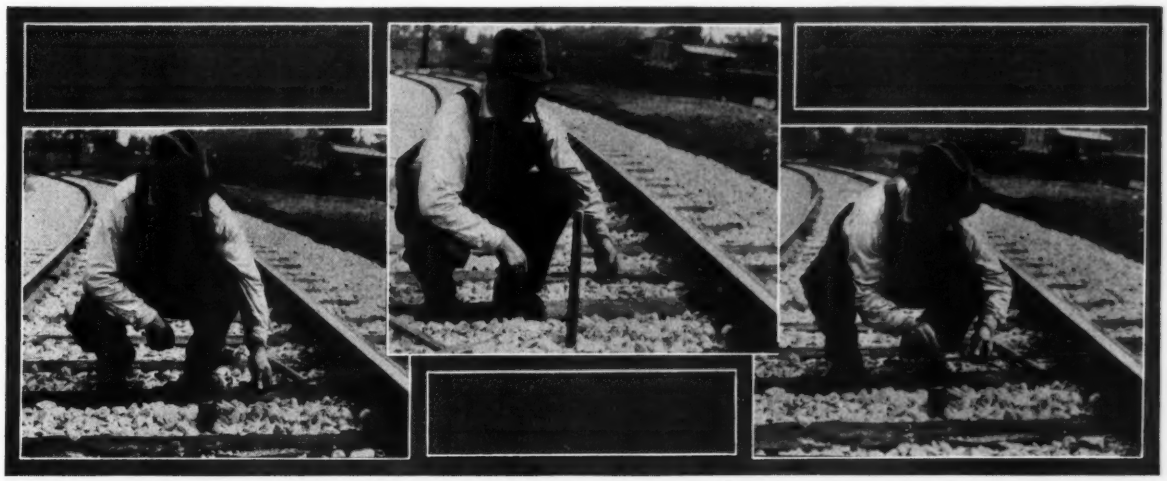
Stakes and Equipment for Driving Them

The best type of stake for string-lining purposes has proved to be a stout wooden stake of suitable material such as oak, about 1¼ in. square on top and with ready-pointed bottom. A long, slender point helps the driving and speeds up the work of getting the stake down to a firm setting. A good length for the stakes is about 18 to 30 in. depending upon the type of ballast into which they are to be driven. If the ballast is cinders, the 30-in. stake is preferable because shorter stakes are too easily moved by the track gang when the ties are lined over for the new curve. If the ballast is rock the 18-in. stake is usually quite satisfactory, unless the ballast is quite new, in which case a longer stake should be used. For such materials as chats or screenings, an intermediate length of stake is best.

In rock ballast, or in very compact ballast of any kind, a long steel bar or pin, flat on one end and with a long tapering, hardened point on the other end, will be found to be a valuable aid in speeding up the work of getting the stakes in, as such ballast frequently splits a wooden stake before it reaches

sufficient depth to insure firm penetration. An old lining bar, properly hardened at the tip (which should first be beaten out straight), and cut down to a length of about 38 or 40 in., makes an admirable tool for this purpose. The pin should be driven into the rock ballast first, and as it is drawn up out of the hole, the wooden stake should be inserted quickly to prevent loose rock and dirt from falling into the hole. A steel maul, with flat ends on both sides of the head, and weighing about eight pounds, will be found most satisfactory for the work of driving both the pin and the stakes.

The pin should first be located by measuring from the gage of the high rail the tack distance, as shown below. Then the pin is driven in, followed by the stake. The stake should be driven quite low—so that it does not protrude more than 1½ in. above the top of the ties on each side—to prevent its being hit and



Practical Hints for Setting Stakes

Wrong way to set the tack, the rule is at an angle

The pin used in rock ballast must be set carefully

Right way to set the tack, using pencil with rule horizontal

broken or knocked down by the steam and air lines of passing trains, or by dragging brake beams, etc. This is especially true of those stakes which, because of small throws, are near the center of the unlined track, since such stakes are more directly in the line of the air and steam lines than those at one side.

At points where the throws are quite small, and all in the same direction—that is, either all out or all in for a distance of four or five rail lengths—some of the stakes can be omitted and the throw marked on the tie. In places where there is no throw (there are frequently such places on nearly all curves) it will suffice to write "O. K.—No Throw" on the nearest tie in yellow chalk or keel.

In setting center line stakes, the measurement from the gage line of the high rail to the tack in the stake should be made in the same manner as the original measurement was made when recording the data on the curve. In other words, if the tape was held about on a level with the tops of the two rails in taking the original ordinates before throwing, it should be held at about the same angle when the stakes are set. It goes without saying that, unless some precaution is taken to get approximately the same angle every time, the angle of measurement will be different on every stake set. As this is unsatisfactory, it is best to adopt some rule for the measuring, and then follow the rule as nearly as possible. In other words, all measurements should be made level (for example), or else all measurements should be made in the plane of the two rails. In either case, it will be necessary to sight down over the tape to the top of the stake, in order to locate the exact point at which to drive the tack. This can best be done by the aid of a small ruler or a pencil, as the eye can better determine whether the ruler or pencil is vertical than it can whether the line of sight alone is vertically over the tape graduation.

In driving the stake, the person driving it should stand near the center of the track and two feet or so away from the stake. In other words, he should stand in such a manner that he can see whether the stake is vertical and has not shifted across the track (between the two rails) as a small amount of shift this way is much more important than a greater amount along the center line of the track. Where there is any considerable amount of superelevation in the high rail, it will be found that there is a decided tendency for a stake to "slide" down-hill or toward the lower rail as it is being driven. In view of this fact, it is generally wise to set the point of the stake from a half inch to as much as three inches nearer the high rail than the actual point where it must finally be placed; after which it can be allowed to slide back to the desired point as it is being driven down.

Cases will frequently be encountered where the string-lining station or the joint is on a tie or is located between two ties where there is scarcely sufficient space in which to drive a stake. In this case, of course, it is necessary to set the stake to one side or the other. However, it should be remembered that this will change the effective length of the chord; and as the middle ordinates vary as the square of the chord length, some slight correction may be necessary where the ordinate is unusually large. For example: suppose that a curve has been measured with a 66-ft. chord, that the revised middle ordinate is found to be 56 (tenths of an inch), and that a stake cannot be set opposite a particular station, but must be set two feet farther away (toward the next station or joint). Then the actual chord length is not 66 ft., but 68 ft.; and the ordinates will vary as 66 squared is to 68 squared or as 4,356

is to 4,624 or 94.3 per cent. Consequently, 56, the ordinate to set is only 94.3 per cent of the ordinate that must be measured on account of the lengthening the chord; and, instead of measuring 56, the recorder or person driving the stakes, must measure 59 (tenths of an inch). By the same reasoning, if the next stake he drives is in the correct position, the chord length will be 2 ft. *less* (because the other one was 2 ft. longer) than 66 ft. or 64 ft.; and he must measure an ordinate of 94.0 per cent of 56 or 53. The correction for a move of 1 ft. either side of the joint is, for a chord of 66 ft., approximately 3 per cent; for a 2-ft. move and a 66-ft. chord, it is approximately 6 per cent. As even 6 per cent of a small ordinate such as 10 (or one inch) is practically negligible, the correction is advisable only when the ordinates are rather large, as illustrated.

Some roads make it a practice to set permanent track centers either in the center of the track, or at one side. On double and multiple track roads, it is usually the custom, where such stakes are set, to place them between the tracks.

As a rule, permanent track center stakes are not really permanent, but move with the ballast. Any movement obviously destroys their value. Moreover, if set in the center of the track, they cannot remain there long without being hit by some dragging part on a train—a further argument against them.

If uniform track centers are carried throughout the length of a tangent, they must necessarily be widened through the curve. Because of the poor tapes which section foremen commonly carry, and because it is very difficult for them to measure along the radial line of the curve, it usually happens that when the track centers are thus widened, they are not uniform around the curve. Added to this, is the fact that, because of the different spirals on the ends of the curve, the throws required to line two curves will not be such as to make the track centers also uniform. Small variations one way or the other from a uniformly widened center around a curve are not particularly noticeable, anyway. The value of permanent centers is, then, seen to be doubtful. In the author's opinion, they are not worth the time and labor to install them.

Railway Purchases and Expenditures in 1927

DURING 1927 the Class I railroads of the United States spent $1,395,928,000 for materials and supplies, a decrease of $163,104,000, or 10.5 per cent, as compared with the corresponding outlay in 1926. These figures, which were compiled by the Bureau of Railway Economics from special reports furnished by the carriers, represent only the totals of purchases made by the railways direct; they do not include anything for materials bought by contractors or supply companies for use in structures, equipment or supplies sold to the railroads. The reduction in the use of materials is not as large as the decrease in purchases, however, as materials carried in stock at the end of 1927 were less than at the end of 1926 by an amount representing a money value of $27,169,489.

Table I. Partial Statement of Purchases by Class I Roads

	1927	1926
Rail (new and second hand, except scrap)	$101,567,000	$110,648,000
Frogs, switches, crossings, track fastenings and bolts, spikes, tie plates, rail anchors, etc.	72,032,000	83,901,000
Steel bridges, turntables, structural steel, bar iron and steel, forgings, fabricated and unfabricated shapes and pressed steel parts	51,267,000	66,940,000
Cross ties (treated and untreated)	108,215,000	101,175,000
Switch and bridge ties (treated and untreated)	12,127,000	13,792,000
Timber and lumber	48,187,000	62,118,000
Other forest products	7,200,000	9,207,000
Cement	5,811,000	6,977,000
Ballast	23,965,000	25,718,000
	$430,371,000	$480,476,000

The reduction in purchases during 1927 as compared with 1926 for those items used primarily in railway tracks and structures, as indicated by Table I, shows that the total value of rails, ties, structural steel, cement, ballast, etc., bought in 1927 was $430,371,000, as compared with $480,476,000 for 1926, a reduction of $50,105,000, or 10.4 per cent.

Table II. Quantities Purchased 1926-1927

Item	1927	1926
Cross ties, units	97,135,000	93,760,000
Switch and bridge ties, bd. ft.	326,735,000	365,957,000
Timber and lumber, bd. ft.	1,285,289,000	1,580,767,000
Cement, bbl.	2,673,000	3,127,000
Steel rail, gross tons	2,278,000	2,504,000
Ballast, cu. yd.	28,430,000	25,422,000

A comparison of the quantities of track, bridge and building materials purchased is shown in Table II. This shows that the railroads bought less rails in 1927 than in 1926, 2,278,000 tons, as compared with 2,504,000 tons, but bought more ties and ballast.

Capital expenditures were also less during 1927 than in 1926, as indicated in Table III which shows not only the itemized expenditures for those two years but also the expenditures for the first quarter of 1928 as compared with the corresponding period of 1927. While this table shows a marked reduction in the outlay for additions and betterments ($771,552,000 in 1927 and $885,086,000 in 1926) its chief significance lies in illustrating the tendency toward proportionately greater expenditures for fixed property than for rolling stock. In 1923, expenditures for roadway and structures amounted to 36 per cent of the total; in 1924, 43 per cent; 1925, 55 per cent; and in 1926, 58 per cent; while in 1927 they represented nearly 63 per cent. This tendency is evidenced in even more intensified form for the first quarter of 1928 when expenditures for roadway and structures totaled $95,412,000 as compared with $33,016,000 for locomotives, cars and other equipment. In other words, the outlay for fixed improvements in this period was 74 per cent of the total.

Table III. Capital Expenditure in 1927 and 1928

	1927	1926	First Quarter 1928	First Quarter 1927
Locomotives	$ 76,975,000	$108,263,000	$ 10,493,000	$ 19,771,000
Freight train cars	136,490,000	185,792,000	13,601,000	18,192,000
Passenger train cars	53,769,000	58,117,000	5,785,000	12,346,000
Other equipment	21,466,000	19,750,000	3,137,000	5,037,000
Total	$288,700,000	$371,922,000	$ 33,016,000	$ 55 34 ,000
Additional track	$139,175,000	$166,758,000	$ 24,744,000	$ 30 145,000
Heavier rail	43,742,000	42,184,000	9,621,000	8,27 ,000
Additional ballast	16,230,000	16,520,000	.1,922,000	1,540,000
Shops and enginehouses	35,236,000	46,882,000	7,964,000	10,941,000
All other improvements	248,469,000	240,820,000	51,161,000	48,775,000
Total	$482,852,000	$513,164,000	$ 95,412,000	$ 99,676,000
Grand total	$771,552,000	$885,086,000	$128,428,000	$155,022,000

Examination of the table shows that the reductions in appropriations for roadway and structures expenditures have been confined entirely to the outlays for additional tracks, and new shops and enginehouses. On the other hand there were actual increases in the expenditures for heavier rail, additional ballast and the item covering "all other improvements," this being true not only in a comparison of 1927 with 1926 but also in the relation of the first quarter of 1928 with the first quarter of 1927.

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE SEPTEMBER ISSUE

1. *In widening banks by work train, what special precautions should be taken to prevent the new earth from slipping off the slopes of the embankment?*
2. *What are the relative advantages of timber and concrete slabs as bulkheads for timber trestles, taking into account both original cost and maintenance?*
3. *Under what conditions is it advisable to install gage rods on sharp curves? What advantages result from their use?*
4. *Under what conditions is it economical to apply stucco to old frame station buildings?*
5. *What are the most desirable lengths of panel for barbed wire and for woven wire fences? What reasons lead to these conclusions?*
6. *What is the best ballast for ballast deck bridges, from the standpoint of its effect on the deck, where either concrete or treated timber is used?*
7. *What can the track foreman to do protect adjacent fields from grass fires originating on the right of way?*
8. *Where several tanks widely separated are supplied with water from the same pump, and it is impracticable to place the tops of the tanks at the same elevation, what is the best method of controlling the level of the water in the different tanks?*

Keeping Farm Gates Closed

What steps can the section foreman take to see that the farm gates on his section are kept closed?

Co-operation With the Farmers Is Often Effective

By A. R. MacLaren
Assistant Engineer, Mississippi Central, Hattiesburg, Miss.

A section foreman finding a farm gate open should stop and close it unless he sees that it is being used and is doing no harm at that particular time. If it is being used, and the foreman knows that the person using the gate is not careful about keeping it closed, or if he finds a gate open and not being used, he should, at his first opportunity, have a talk with the person responsible. In a courteous and friendly manner he should impress upon this person the mutual benefits to be derived from co-operation in keeping farm gates closed. With the proper manner of approach the section foreman can aid the standing of his company among his neighbors in this matter, as well as in many others. In aggravated cases, the section foreman should make a report to the proper officer each time that gates are found open, and should also record his attempts to have them kept closed.

Both the Farmer and the Railway Have Obligations

By Division Engineer

The importance of keeping farm gates closed should be recognized by every section foreman since open gates permit stock to stray upon the right of way where it may be struck by trains. At the best, this results in expense on account of the foreman having to interrupt his work and to use his gang to drive the stock back through the gate; at the worst, it may result in the derailment of a train, with loss of human life. Because of these contingencies, the section foreman should make every effort to have the owners of the property see that the gates are closed immediately after they have been used, being careful not to lose his temper at such times.

While the users of the gates are under obligations to keep them closed when they are not in use, the railroad is under equal obligations to keep them in condition so that they can be opened and closed with little effort and fastened securely after they have been closed. The foreman, as a representative of the railway, should see that this is done and also that the right of way fence on his section is kept in repair, since attention to these details will often influence the farmer to an attitude of co-operation, and, in any event, will tend to refute any claims resulting from animals being struck by trains.

When the gates and the fence are kept in good order and the farmer persists in leaving the gates open, the foreman should make a record of each time that the gate is found open, noting the date and the members of the gang present at such time, so that if stock is killed by straying through the gate he can include the information in his report and thus furnish evidence for combating damage claims.

In some states, the laws specifically provide that the owner or occupant of the land for which the gates are installed shall keep them closed when they are not in use. The foreman can find out, through his superior officers, whether or not such laws are in effect in the state in which he is located, and if they are, proceedings

can be started under them when other measures fail. The law should be called on only as a last resort, however, since a lawsuit usually means making an enemy of the man who is sued, and it is to the interest of the railroad to have as few enemies as possible for neighbors. In case of a lawsuit the foreman must be careful to have a full record of the dates on which the gates were found open with a list of witnesses who can testify to the facts.

Loss of Camber in Steel Spans

Is the loss of camber in a steel span a sign of distress? What conditions should be investigated when this occurs?

Not Necessarily Alarming

By C. C. Westfall
Engineer of Bridges, Illinois Central, Chicago

True loss of camber in a steel span may be a sign of distress and should call for a careful investigation of the physical condition of the structure, but frequently, what appears to be a loss of camber, is found to be not such in fact, but is due to the span having been designed without any camber. On this account, the absence of camber has ceased to be a matter of alarm with us, although, of course, an inspection is always made to ascertain the cause.

Loss of camber is more apt to occur in a pin-connected truss, on account of wear at the pins; consequently these points should be examined first to see if they are the source of the trouble, especially in the case of the older bridges.

Not Always a Sign of Distress

By L. W. Skov
Office Engineer, Bridge Department, Chicago, Burlington & Quincy, Chicago

The loss of camber in a pin-connected truss is not necessarily a sign of distress, as it may be due to the wearing of the pins and the holes in the eye-bars. When loss of camber occurs, the stresses in the structure should be figured and the bridge inspected carefully, especially for the working of the pins.

In riveted structures, loss of camber is usually an indication that the structure is in distress, and in such structures this should call for a careful field examination as to the condition of the rivets, and the stresses should be figured.

Should Trains Call Signals to Track Gangs?

When a train carrying signals for a following section passes gangs working on the track or bridges, or passing over the track on hand or motor cars, should the whistle be sounded to call attention to those signals?

It Should Not Be Done

By A. R. MacLaren
Assistant Engineer, Mississippi Central, Hattiesburg, Miss.

The rules governing the operation of trains should not provide that the engine whistle signal be sounded for section, bridge or other gangs to call attention to classification signals, for the following reasons:

1. The rule for sounding the classification signals imposes upon the engineman the responsibility of receiving an answer from the party for whose benefit the whistle is sounded. Receiving an answer from gangs would be very apt to cause unnecessary confusion and delay.

2. Maintenance of way gangs are often engaged in work which does not affect following sections in which cases the classification whistle signal would not be of any real use to them.

3. The maintenance of way rules should, and nearly all of them do, require the employees to know the classification signals carried by trains. Furthermore, these rules should require the observation of passing trains to determine what signals are being carried.

4. Maintenance of way gangs are expected to get a line-up on trains each morning and should be required to do so before attempting work which may interfere with train operation. They also should be required to display the proper caution signals when and where a reduction in schedule speed is necessary because of work they are performing.

The Practice Would Not Be Beneficial

By R. H. Smith
Superintendent, Norfolk & Western, Roanoke, Virginia

Whether or not this should be done depends upon the regulations of the individual railroad. The standard code of rules and regulations does not require it. To my mind, it would place an undesirable burden upon an engineman to hold him responsible for observing all track, signal and bridge forces working along the track or motor cars parked beside the track and sound the "green signal" whistle for each one. There is too much chance of his overlooking one, due to his attention being attracted by his other duties. In case of an accident on account of a failure of the track force or motor car operator to observe the signal displayed for a following section, the responsibility would be divided between the engineman of the train displaying signals for failure to sound the proper whistle signal and the foreman or motor car operator for failing to observe the signal.

It does not place an unreasonable burden on a motor car operator or track force to observe all passing trains for signals and it centers the responsibility by placing the obligation for observing the signal directly on the wayside force or motor car operator.

Spray Painting of Buildings

What are the limitations in the use of the spray-gun for the painting of the interiors and exteriors of buildings?

No Limitations Peculiar to This Method

By Assistant Engineer of Buildings

With the proper equipment and properly trained operators, there are no limitations in the use of the spray-gun which are not also found in hand painting, while the method provides distinct economies. We use the spray for painting the exteriors and interiors of all buildings, including passenger stations, and are able to carry on the work satisfactorily with no undue discomfort to the occupants.

In painting interiors by this method, care must be taken to prevent the escape of the spray into the air of the room, but this can be done by proper attention to the manipulation of the spray, and none but men experienced in the use of the spray should be assigned to this class of work.

Limitations Are Becoming Less

By Supervisor of Buildings

The limitations in spray painting for either the exteriors or interiors of buildings are rapidly disappearing, on account of the better knowledge of details gained through experience and the development of the appa

ratus to overcome the objections which were found when the process was new.

One of the principal limitations for this method, which applies to either interior or exterior painting, is the size of the job, where some small isolated building must be painted without waiting its turn in the regular program, but this is being obviated in many cases by the introduction of small units which are readily portable.

Some trouble has been experienced in the painting of the interiors of certain kinds of buildings, such as stations where the room must be kept in use while the work is going on, on account of the fine particles of paint being carried into the air. For this reason some roads, which spray-paint the outsides of buildings, continue to paint the interiors by hand. Other roads, by training their operators, are able to use the spray for interior painting, with no other objections than are met with in the use of the brush.

Finding the Degree of a Curve

How can the section foreman determine the degree of a curve?

A Simple Method

By L. J. DRUMELLER
Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

A very simple method by which a foreman can determine the degree of curvature is take a string 62 ft. long and stretch it tightly, holding the ends against the gage side of the high rail. The degree of curve can then be determined by measuring from the middle point of the string, or 31 ft. from the end, to the gage of the rail. Each inch of the distance so measured will be equivalent to one degree. As an example, if the distance measured is 4¾ in., the degree of curve will be 4¾ deg., or 4 deg. 45 min.

Another Method

By C. E. SANDOVAL
Section Foreman, Southern Pacific, West Chandler, Ariz.

It is not an easy task for the section foreman to determine the degree of a curve unless the following rule is used.

By measuring the middle ordinate of any convenient chord, the degree of the curve can be calculated from the relative values of the ordinate and the chord. Since the track is not likely to be in perfect alinement, it is well to measure the middle ordinate for the same length of chord at different points of the curve. As, also, the middle ordinate of a chord measured to the inner rail will somewhat exceed the middle ordinate of the same chord measured to the outer rail, the ordinate of each chord should be measured for both rails and the average of the two taken as the value of the ordinate.

Having measured the middle ordinate of two or more chords, select a portion of the curve which has the average ordinate and apply the following rule: Measure the middle ordinate for a chord of 95.75 ft. or 95 ft. 9 in. Express the ordinate in feet and decimals of a foot and multiply by 5. The result will be the degree of the curve in degrees and decimals of a degree.

[These methods illustrate two ways of determining the degree of any curve with no other tools than a tape line and a rule. The first method, which is frankly an approximation, is sufficiently accurate for all practical purposes for which the foreman may need to know the degree of curve, and may be safely used in this way for curves up to 20 or 25 deg. The approximations in this method consist of the selection of a chord 62 ft. in length, while the exact value would be 61.8 ft., and the measuring of the ordinate on the outer rail, while the degree of curve is based on the location of the center line of the track. These differences, however, are too small to be taken into account unless greater mathematical accuracy is desired.

The second method is more nearly mathematically correct for sharp curves and should be used where such accuracy is essential. It may be said, however, that such accuracy is seldom needed by the section foreman and that the first method will give results well within the required limits, while it is much easier to remember and to apply.—Editor.]

Attention to Rail Anchors

What attention should the section foreman give to rail anchors to insure their proper functioning at all times?

They Should Be Installed Properly and Inspected Often

By L. J. DRUMELLER
Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

The proper functioning of rail anchors depends very largely, and in some cases entirely, on their initial installation, especially in the case of certain one-piece anchors, where the tendency to overdrive them springs the steel and goes far to prevent their being used again.

The section foreman should instruct the track walker to give as much attention to the rail anchors as he does to any other part of the track structure to insure their proper functioning. They should be kept tight at all times, bearing against the faces of the ties opposite to the direction in which the track is creeping. Everyone concerned with the maintenance of track should be impressed with the importance of the proper maintenance of rail anchors and should give them as much attention as any other part of the track.

Precautions to Be Observed

By A. R. MACLAREN
Assistant Engineer, Mississippi Central, Hattiesburg, Miss.

In the absence of definite instructions section foremen should arrange to make periodic inspections of rail anchors. The frequency of the inspection should depend upon local conditions, such as whether the track is single or double; the traffic light or heavy; the tonnage balanced or unbalanced; grades; the known tendency of certain stretches of rail to run; the length of time the rail anchors have been applied, etc. The inspection may or may not be combined with the inspection of other track materials, depending, also, upon local conditions.

The inspection should determine—(a) That a sufficient number of rail anchors are installed to prevent the rail from running in either direction; (b) That no anchors are loose; (c) That all anchors are developing their full resistance by resting firmly against the ties; (d) That all rail anchors are resting against sound ties; (e) That pockets are not left in the ballast if rail anchors have moved back and forth with the rail; (f) That the rail anchors are protected from brine drippings.

Hints on the Installation of Rail Anchors

By J. B. WILSON
Section Foreman, Missouri-Kansas-Texas, Denison, Texas

We all know that "running" or "bunched" rail causes bad riding track and shortens the life of the rail; this leads to the question whether the railroads are getting as much service as is possible from anti-creepers. In cases where no anchors or an insufficient number have been applied, and the rail has run, it is possible to secure

the proper expansion by applying anchors, and to hold the expansion after it has been corrected, much more cheaply than by driving the rail and with no damage to the rail.

A typical case will illustrate this method. We will assume that we have a sag in the track and that the rail is bunched in the lower part of the sag. To prevent further creeping of the rail towards the bottom of the sag, the joints should be loosened during the hottest part of the day each way from the tops of the sag to the points where the rail is tight. This will permit the rails to close up in the expansion spaces, and after this has been done, the joints should be tightened and rail anchors should be applied to hold the rail from further movement toward the bottom of the sag. The distribution of the expansion in these stretches of track usually cannot be done at one operation, but must be repeated at intervals, adjusting the anchors each time.

After this has been done, the expansion in the tight rail can be opened during cool weather by the same process, i. e. loosening the joints progressively from the ends of the tight rails toward the bottom of the sag, permitting the rails to pull apart, when the joints should be tightened and rail anchors applied. This may have to be repeated several times to distribute the expansion equally.

In cases similar to the one just cited, conditions are usually aggravated by the presence of a bridge at the lowest part of the sag, which makes it all the more necessary to keep the rail from bunching at that point.

Salvaging Parts of Pumps

Is it practicable to salvage parts from pumps which have been scrapped? What special precautions should be taken in conditioning such parts for further service?

Not Usually Economical

By J. R. Hickox
Hydraulic Engineer, Chicago, Burlington & Quincy, Chicago

As a rule there is no economy in attempting to salvage parts from pumps which have been scrapped, since such pumps are usually of obsolete types, which it is not desirable to retain in service owing to the difficulty in obtaining repair parts and to their inefficiency as compared with newer types. When such pumps are scrapped the various parts are usually badly worn and require more work to put them in condition than they are worth after the work is done.

Apart from discarding pumps because of obsolescence or inefficiency, few pumps are scrapped except in cases of accident where the machine is so badly damaged that it cannot be reassembled with repair parts as cheaply as a new one can be secured. In such cases, of course, any parts which are serviceable should be retained and put into condition for further use. In reconditioning these parts, care should be taken to work to close limits with the original design so that they may be used in the repair of other pumps of the same type without further adjustment.

Not Economical in Most Cases

By Inspector of Water Service

It is seldom economical to attempt to salvage parts from pumps which have been scrapped since such parts are usually badly worn and require considerable work to put them in condition for further service. When a pump has reached a point where it must be scrapped, it is our practice to inspect the various parts and to salvage such parts as can be reconditioned economically, but as a rule we find little that can be saved to advantage. This depends to a large extent on the type of pump. If the pump is of modern design, for which repair parts can be obtained readily, the decision as to reconditioning will hinge on the cost of reconditioning, as compared with the cost of purchasing the repair parts new. On the other hand, with pumps of old designs, for which repair parts cannot be obtained, the decision depends on the comparison between the cost of reconditioning and the cost of making the repair parts in the shops.

Placing Shallow Pipe Culverts

What should be the minimum amount of fill over a pipe culvert? To what extent does this vary with the diameter of the pipe and the character of the material?

May Be Difficult to Secure the Desired Minimum

By I. L. Simmons
Bridge Engineer, Chicago, Rock Island & Pacific, Chicago

In placing pipe culverts we try to use 1 ft. 6 in. below the base of the ties as a minimum, with preferably a depth of 1 ft. below the bottom of the ballast, but it is sometimes difficult to obtain these depths, which are needed to distribute the weight imposed by trains and also to protect the pipe from injury in case of derailment. We have found these depths satisfactory and have never had any failures from breakage where they were used, except in a few instances where the culverts were of vitrified pipe or some of the earlier types of non-reinforced concrete.

We use no special precautions in placing pipes at shallow depths, other than are used for other pipe culverts. When a pipe culvert is installed it should be done in such a way that it will never have to be touched again, as far as troubles due to installation are concerned. If instructions are issued to use special precautions in certain cases, there is a tendency to neglect these measures in other cases, and it is felt that better results will be obtained if it is understood that the amount of care to be exercised in all cases must be such as is needed to insure a satisfactory job.

Should Preferably Be Not Less Than Three Feet

By Bridge Engineer

The problems introduced by a small amount of cover for pipe culverts are in some ways the same as those encountered for such culverts under high fills; resistance to the pressure exerted on the pipe. In high fills, the pressure is exerted by the weight of the material over the pipe; where the culvert is near the bottom of the ties, it is subjected to the impact of passing trains. For this reason it is inadvisable to place the top of the pipe above a point where the pressure of the passing loads will be distributed equally through the ballast and covering of the pipe.

Tests made by the Pennsylvania some years ago showed that 24 in. of ballast is required under the ties to distribute the load equally to the roadbed, and computations made by German scientists at about the same time corroborated this result within close limits. Consequently, this is a safe rule to follow and some roads, to allow a margin of safety, specify that the cover shall be not less than three feet thick.

In extreme cases it may be necessary to use several pipes instead of one of sufficient diameter to carry the drainage, or else to use some other form of opening. Such cases often require close study to determine the best and most economical course to adopt but such study is well worth while, since many pipe culvert failures are due to an insufficient covering.

Sorting Discarded Materials

A further answer to the following question discussed in the June issue:

When shipping in discarded materials, should the track foreman attempt to separate scrap from usable material or should this be done at a central point?

Foremen Should Not Try to Sort Out the Scrap

By H. M. Church
Division Engineer, Chespeake & Ohio, Hinton, W. Va.

Released track material should be separated from the scrap and used in the work at hand, when this can be done immediately. All other materials should be cleaned up and taken in daily for assembly for shipment, and no attempt should be made to separate the usable material from the scrap.

Where there are regularly scheduled supply trains for the distribution of supplies, the released materials should be loaded on this train for shipment to a central point where the materials can be separated and due care given to the conditions for resuse. Greater economy will be effected by centralized control, avoiding a large quantity of dead stock on the line and making the material available for quick disposition and turnover.

Building Up Worn Steam Shovel Teeth

By I. W. Eger
System Welding Supervisor, Denver & Rio Grande Western, Denver, Colo.

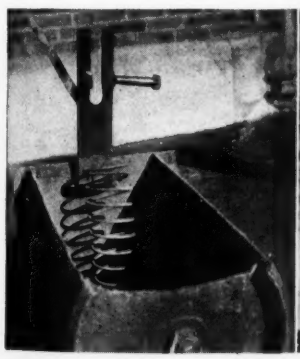
THE apparatus shown in the illustration is designed for building up worn steam shovel teeth. It consists of an old air reservoir cut to a length of 40 in. with a piece of ¼-in. material welded in for the head. On the inside of one end a 6-in. hinge is welded, to which is attached a slotted upright on which the shovel tooth is bolted ready for building up. When attached, the tooth is bent over in position for welding, the spring holding the arm and tooth above the surface of the water. In building up a small tooth a 6-in. air brake cylinder spring is sufficent but in working on the larger teeth it is necessary to insert a 4-in. spring inside the larger one to provide for additional tension. The springs are held in place by a lug welded to the bottom of the tank.

To insure the building up of the tooth to standard size and also to prevent drawing it off to one side while welding, it is advisable to use a template, which is constructed of ¾-in. square iron and fitted around a new tooth to get the proper taper. With the worn tooth bolted in place and covered by the template, a piece is cut from the leaf of a locomotive spring, shaped at the bottom to the contour of the worn tooth and of sufficient length to fill the space to the end of the template. This piece of steel is used to build around. The quenching lever shown is of sufficient length and is so shaped that it can be worked with the foot while the electrodes are being changed.

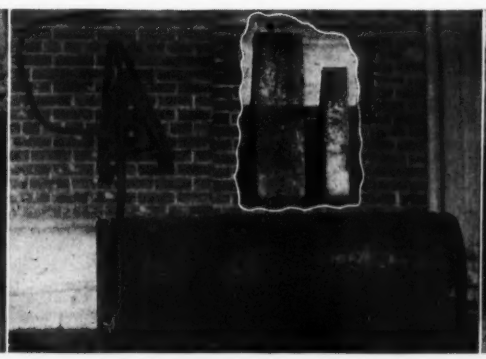
Care should be taken to see that the work progresses from the dipper tooth towards the point, thereby eliminating unnecessary strains at the line of fusion with the manganese point. One-quarter inch high carbon coated rods should be used and a deep penetration secured in the manganese; at the end of each electrode the quenching lever should be pressed down with the foot to immerse the work in the water. As soon as the electrodes are changed, the quenching lever is released and the spring raises the tooth out of the water, sufficiently cooled to enable operations to be resumed without danger of breaking the new work, as manganese will crumble if it becomes overheated. The importance of quenching will be more easily understood if we remember that manganese metals contain 13 per cent of manganese, and being very volatile in a molten state, will pass off into the atmosphere and leave a brittle condition at the line of fusion if not cooled promptly. The work should be cooled after the application of each 14 in. electrode. It will also be noted that considerable time is saved by quenching, as work can be resumed at once.

The high carbon rod is built on the tooth until it is of standard size; then the template is removed and a layer of non-machineable metal is laid completely over the added metal, extending up the sides of the tooth and overlapping the original metal on the face as well as the sides. In this connection when a steam shovel is used in slag or other abrasive substances, it is advisable to put a $\frac{3}{16}$-in. coating of non-machineable metal on the surfaces that receive the most wear before a new tooth is put into service.

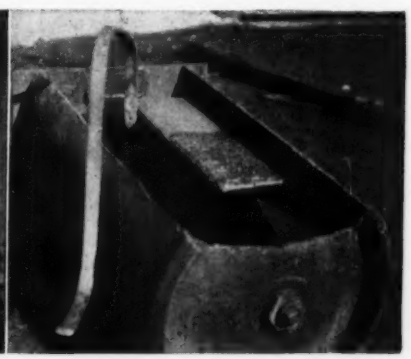
By the use of this method it is not necessary to have the teeth drawn out in the blacksmith shop before welding. The cost of this work averages $1 a tooth, thus saving about $16 on the cost of a new tooth. It has been found by actual experience that a tooth so built up lasts about twice as long as a new one. With this quenching tank it is possible to deposit from 8 to 10 lb. of electrode per hour.



The Improvised Tank

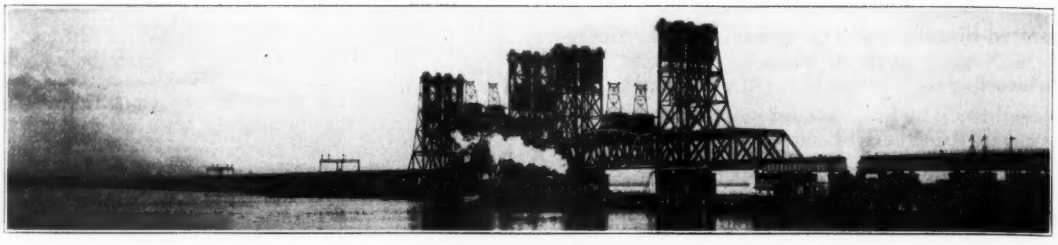


(Insert) A Couple Steam Shovel Teeth
The Tank with Template on Upright



A Tooth Bent Over in Position for Welding

New and Improved Devices



A Gage for Measuring Rail Batter

AN INSTRUMENT for measuring accurately and quickly the amount of batter of rail ends has been developed by H. H. Morgan, manager of the rail and fastenings department of the Robert W. Hunt Company, Chicago. The device consists essentially of a steel straight edge 18 in. long and ¾ in. wide on the base, with an automatic dial indicator showing variations to 1/1000 in. The dial is at one end of the straight edge and the pointer is actuated

The Dial Shows Variations to 1/1,000 in.

by a metal point which rests upon the rail, following the top of the rail as the straight edge is moved along and thus, through the dial readings, providing a complete profile of the batter.

In operation, the gage is set on the top of the rail with the dial end toward the joint and about 6 in. from the end of the rail, and the dial is turned until the arrow indicator registers zero. The straight edge is then moved toward the joint, two pointed attachments on its side being ½ in. in advance of the dial indicator so that when these points reach the end of the rail the dial indicates the amount of batter at the distance from the end of the rail as specified by the manual of the A. R. E. A. After

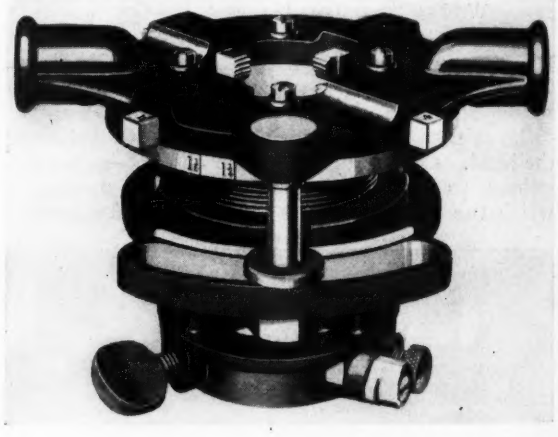
Side View of Hunt Rail Batter Gage

the batter of one rail has been measured the instrument can be lifted quickly and swung around to be placed on the adjacent rail, a knob on the top of the straight edge facilitating this operation. The design of the straight edge provides rigidity and stablity, with a weight which permits its convenient handling, and which also permits its being left on the top of the rail while the amount of batter is being recorded.

The Robert W. Hunt Company, in order to make this instrument available to the railroads at minimum cost, has arranged for its manufacture and sale by the Humboldt Manufacturing Company, Chicago, at a fixed price, with no royalty charge.

A New Adjustable Die Stock

A NEW self-contained adjustable die stock for threading pipes ranging in size from one inch to two inches without changing the dies has been developed and placed on the market by the Borden Company, Warren, Ohio. The device is made in two models which have been designated as No. 11



No. 11 Beaver Adjustable Die Stock

Beaver, plain, and No. 11A Beaver, ratchet, superseding the models known as No. 25 Beaver, plain, and No. 26 Beaver, ratchet.

In these stocks the dies are always in the tool ready for use and can be adjusted quickly to cut any desired size, including threads either over or under standard as may be necessary. The die head and the threaded barrel are separate parts so that in case of injury to either, it can be replaced without the necessity of purchasing the other part. All parts are interchangeable, insuring that repair parts will fit. The dies are made of high-grade alloy steel, specially hardened and tempered for threading all kinds of pipe, including brass pipe.

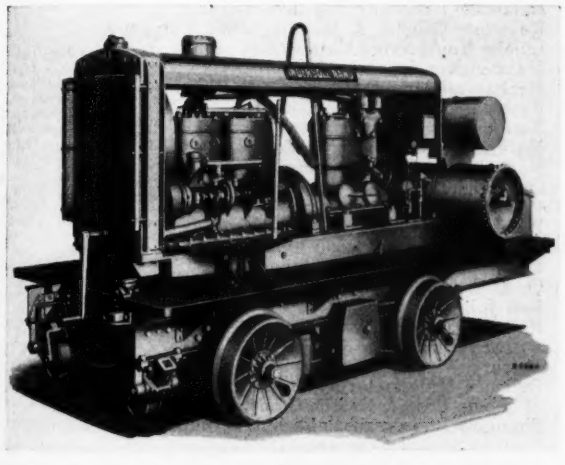
The pipe-gripping device centers the pipe accurately and quickly by two knurled screws, leaving only a thumb screw to be tightened after the die stock is placed on the pipe. There are no loose bushings and after the gripping device is set to size

only a straight thread can be cut normally although it can be adjusted easily to cut crooked or drip threads if desired. It is said that the device will grip couplings of any size for threading short nipples.

Tie Tamper Compressors Embody New Features

THE Ingersoll-Rand Company, New York, has recently brought out improved models of its 4-tool, 8-tool and 12-tool compressor units, the most important change in which is with respect to the method of drive. Heretofore, all the self-propelled tie tamper compressors manufactured by this company have depended upon friction drive for their locomotion. In order to provide what is said to be a more desirable and still more durable method of drive, the new compressor models are equipped with an independent motor drive, the prime mover being a four-cylinder air motor which is connected to the drive axle by a sprocket and chain arrangement. This method of drive, which is more positive in action, and which provides a wider range of speed than was possible with the friction type of drive, also permits better control.

Another feature of the new method of driving is that the air motor, which is mounted beneath the car, functions also as an auxiliary brake, so that when on descending grades there is no possibility of the unit attaining a dangerous velocity. The valve operation of the air motor is linked to a long lever which extends above the floor of the car, inside the compressor housing, and high enough to enable the operator to reach it when in a standing position. Through this arrangement, the operator has full control of the air motor, and at the same time, is in the proper position to reach the foot brake.



The New Model 8-Tool Compressor With Air Motor Drive

As the foot-brake shoes act on the wheels of the idle axle while the air motor is connected with a driving axle, the braking action secured is practically equivalent to providing the compressor with four-wheel brakes. The maximum braking power is obtained by stepping on the foot brake and throwing the air motor into neutral simultaneously.

Other improved features in the new models consist of the provision of a draw bar connection at each end for towing purposes, and a new type of transverse wheels for derailing the equipment. The new transverse wheels are of the swivel type, and are fitted with a bar hole for raising and lowering them. Through this arrangement the new wheels can be used as lifting jacks, and when so employed, they obviate the necessity of using hydraulic, pneumatic or other types of jacks for moving the compressor.

A Three-Speed Gasoline Crane

THE American Hoist & Derrick Company, St. Paul, Minn., has developed and placed on the market a gasoline-operated locomotive crane with a universal-joint automobile-type of gear shift for three speeds, thus permitting the varying of the speed with the work to be done. The low gear is used for obtaining a powerful start or for handling heavy loads, the intermediate gear for ordinary crane work or traveling and the high gear for light loads or fast travel, thus providing flexibility with economy since only one man is necessary for the operation of the crane and the consumption of fuel can be regulated according to the requirements of the work.

The "American" Gasoline Three-Speed Crane

Close attention has been given to the design of the machine to afford efficiency and safety. The machinery deck revolves on 20 bronze-bushed conical rollers and is locked to the car body at the outer circumference of the bull gear by an "American" interlocking gib ring. These features permit easy slewing by reducing friction and distribute the load instead of concentrating it on a king pin. The car body is built up of structural steel, with Bethlehem girder beam side sills and the center casting supporting the machinery deck is of solid semi-steel.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 23-25, 1928, Hotel Statler, Boston, Mass.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April, 1929.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 18-20, 1928, Book Cadillac Hotel, Detroit, Mich.

Track Supply Association.—A. H. Told, secretary, Positive Rail Anchor Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

With the Associations

American Wood-Preservers' Association

Eight members of the Executive committee met at Chattanooga, Tenn., on June 12 to consider the work of the association. A number of changes in committee personnel were approved, after which detailed consideration was given to the preparation of the program for Users' Day at the next annual convention.

American Railway Engineering Association

Thirty-one Japanese members of the American Railway Engineering Association have addressed a petition to the Board of Direction asking that E. H. Fritch, secretary of the association, be sent to the World Engineering Congress in Tokio in November, 1929, as an official representative of the association.

W. K. Hatt, professor of civil engineering at Purdue University, La Fayette, Ind., has been designated by President Faucette to represent the association at the opening of a library at the University of Louvain, at Louvain, Belgium, on July 4.

More than 120 applications for membership have been received since the last convention, including one from a young woman, the second to apply for membership. This is a larger number of applications than has ever been received in the same period previously. One member, C. E. Johnston, president of the Kansas City Southern, has been instrumental in securing 32 applications, including 9 from railway presidents, 15 from operating vice-presidents, 3 from general managers and 5 from general superintendents.

The Board of Direction held its summer meeting at Atlantic City, N. J., on June 27.

During the past month a number of the committees have held meetings, including the Track committee at Montreal, Que., on May 30; the Committee on Economics of Railway Location on June 5 at Chicago, Uniform General Contract Forms at Boston, Mass., on June 8; Wood Preservation at Chattanooga, Tenn., on June 12-13; Grade Crossings at Chicago on June 15; Water Service at Chicago on June 19 and Records and Accounts at New York on June 27.

Roadmasters Association

The chairman of four of the five technical committees met with members of the executive committee at the Book-Cadillac hotel, Detroit, Mich., on June 23 to complete arrangements for the hotel facilities, to go over committee reports and to make other arrangements for the next convention. The review of the committee reports showed that they are already in almost final form.

In accordance with the action taken at the last annual convention a bronze tablet has been erected at the grave of William C. Kidd, former secretary of the Track Supply Association, commemorating his constructive work for the two organizations.

Although three months intervene before the convention and exhibit, the Track Supply Association has received applications for membership from 52 supply firms. Space was assigned to these firms at a meeting on June 23. There is still some space remaining which will be assigned in the order of receipt of applications. The firms which have taken space to date include the following:

American Chain Company
American Fork & Hoe Company
American Hoist & Derrick Company
American Steel & Wire Company
American Valve & Meter Company
Balkwill Manganese Crossing Company
Bethlehem Steel Company
Buda Company
Chicago Pneumatic Tool Company
Chipman Chemical Engineering Company
Creepcheck Company
Cullen-Friestedt Company
Duff Manufacturing Company
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Hayes Track Appliance Company
Hubbard & Co.
Ingersoll-Rand Company
Ingot Iron Railway Products Company
O. F. Jordan Company
Kalamazoo Railway Supply Company
Keystone Grinder & Manufacturing Company
Lundie Engineering Corporation
Maintenance Equipment Company
Mechanical Manufacturing Company
National Lock Washer Company
National Malleable & Steel Castings Company
Nordberg Manufacturing Company
Northwestern Motor Company
Oxweld Railroad Service Company
P. & M. Company
Pettibone-Mulliken Company
Pocket List of Railroad Officials
Positive Rail Anchor Company
Q. & C. Company
Rail Joint Company
Railroad Supply Company
Railway Purchases & Stores
Ramapo-Ajax Corporation
Reliance Manufacturing Company
St. Louis Frog & Switch Company
Simmons-Boardman Publishing Company
Skelton Shovel Company
Snap-On Wrench Company
Syntron Company
Templeton, Kenly & Co., Ltd.
Union Switch & Signal Company
Verona Tool Works
Western Wheeled Scraper Company
William Wharton, Jr., & Co.
Woodings Forge & Tool Company
Woolery Machine Company

Bridge and Building Association

Six of the eight chairmen of committees on technical subjects met with the members of the Executive committee at Chicago on June 9 to consider the year's work. Reports indicated that all of the committees will complete their work by August 1. The Local Arrangements committee reported on the plans for the Boston convention next October, which plans are farther advanced than usual at this time of the year. A number of applications for membership were voted on favorably, bringing the total number of members received since the last convention up to the high level for this period.

HEAVY CONVENTION TRAVEL—A total of 24,000 persons above the normal movement entered Kansas City, Mo., on June 11-12 to attend the Republican convention.

The Material Market

IT IS QUITE certain that the average railway man has the impression that the past six months has been a period of declining volume of business. This is based on the fact that freight carloadings have been less, that manufacturers representatives have complained of increased sales resistance and that the industries have pointed to smaller profits and diminishing unfilled orders. For this reason it will be a surprise to many who are not conversant with the statistics that in the fields of two primary materials, steel and wood, the first six months of 1928 has been a period of record sales and production. For example, the production of steel ingots for the first five months was 21,049,919 tons, which is approximately three per cent more than that for the first five months of 1926, the previous high record. Furthermore, prices averaged higher at the close of the half year than at its beginning.

It is true that a seasonal decline in demand set in at the beginning of May and has continued to the present time. Production receded from 75 per cent to 70 per cent of capacity at Pittsburgh and from 90 per cent to 83 per cent at Chicago during the month. However, in spite of this the steel manufacturers in the Pittsburgh area announced an advance in the prices of plates, shapes and bars from 1.85 cents per pound to 1.90 cents for third quarter business. The new quotation has been untested. Unlike the effect of earlier announcements of advances in price, this one did not even result in any appreciable stimulation in specifications for delivery against orders placed at the lower rate, and some new business has been placed at the old price.

Iron and Steel Prices Per 100 Lb.

	May		June	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.80	$2.80	$2.80	$2.80
Track bolts	3.80	3.80	3.80	3.80
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.15	2.15	2.15	2.15
Boat spikes	3.00	3.00	3.00	3.00
Plain wire	2.50	2.55	2.50	$2.50 to 2.55
Wire nails, keg	$2.55 to 2.65	$2.60 to 2.70	$2.55 to 2.65	2.60 to 2.70
Barb wire, galv.	3.35	3.40	3.35	3.40
C. I. pipe, 6 in. to 12 in., ton	39.20 to 41.20			40.20 to 41.20
Plates	1.85	2.00	1.85 to 1.90	2.00
Shapes	1.85	2.00	1.85 to 1.90	2.00
Bars, soft steel	1.85	2.00	1.85 to 1.90	2.00
Rivets, struc.	2.90	3.00	2.90	3.00
Con. bars, billet	1.85 to 1.90		1.95 to 2.00	
Con. bars, rail.		1.85 to 1.95		1.85
Rails per gross ton f.o.b. mills	43.00	43.00	43.00	43.00

It was expected that the Pittsburgh announcement would be followed by corresponding action by the mills in the Chicago territory where the prevailing quotation has been 2 cents per pound, but third quarter prices have not been given out and while 2 cents at Chicago is a stronger quotation than 1.85 cents at Pittsburgh some concessions are still being made as the third quarter opens.

Similar weakness is observed in the case of wire and wire products, in which field the manufacturers have been making every effort to establish prices of $2.50 for plain wire and $2.65 for wire nails at Pittsburgh with differentials of 5 cents more at Chicago. But these prices are weak and buyers of considerable quantities have been able to obtain concessions of from 5 to 10 cents per 100 lb. The Chicago Heights producers of rail steel reinforcing bars have been endeavoring to set the price at 1.90 cents per pound, but the going rate is now definitely 1.85 cents. The prices of track accessories, which are much less subject to variation than almost any other iron and steel product, are steady. Efforts to restore the quotation of steel tie plates to $2.25 per 100 lb. after the recession to $2.15 have been unsuccessful. An exception to the downward tendency in prices is observed in cast iron pipe. Prices on this commodity advanced $2 per ton during May and are still strong, as indicated by a decreasing margin between the maximum and minimum quotations.

New rail orders have been confined to small miscellaneous tonnages and the seasonal recession in production is now taking place, although the mills at Chicago were still rolling at 80 per cent late in June. The producers of accessories, however, are busy, their operations being stimulated by new inquiries of considerable volume. The largest of these is that of the Pennsylvania for 330,000 tie plates, 9,000 kegs of spikes, 94,500 pairs of angle bars and 342,000 bolts.

Scrap Prices Per Gross Ton at Chicago

	May	June
Relaying rail (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	14.50 to 15.00	14.75 to 15.25
Rails less than 3 ft. long	15.25 to 15.75	15.50 to 16.00
Frogs and switches cut apart	13.50 to 14.00	13.50 to 14.00
Steel angle bars	14.50 to 15.00	14.25 to 14.75

The scrap market, which is especially sensitive to the relation of supply to demand, is quiet and prices are weak.

Current statistics prepared by the lumber manufacturers indicate greater demand and shipments than for the corresponding period last year. These figures, however, are not conclusive because the available statistical data cover only about 40 per cent of the total volume of business. Furthermore, the fact that the figures for shipments show an increase of 5 per cent over last year does not check with the record for lumber carloadings which is 5 per cent under last year, rail shipments being estimated at 85 per cent of the total. Statistical data are also upset by the fact that figures for the West Coast Lumberman's Association cover the operations of about twice as many mills as last year. However, the general tone of the lumber industry is healthier than a year ago. Both sales and shipments exceed production and prices are steady, the quotations given in the table for June averaging about the same as those for May.

Southern Pine Mill Prices

	May	June
Flooring, 1x4, B and better, flat	$38.14	$38.58
Board, 1x8, No. 1	33.68	35.16
Dimension, 2x4, 16, No. 1, common	25.85	27.73
Dimension, 2x10, 16 No. 1, common	28.57	30.08
Dimension, 2x4, 16, No. 2, common	21.63	22.67
Dimension, 2x10, 16, No. 2, common	23.36	24.12

Douglas Fir Mill Prices

	May	June
Flooring, 1x4, B and better, flat	$23.25	$23.75
Boards, 1x8, No. 1	16.25	15.75
Dimension, 2x4, 16, No. 1, common	18.00	18.25
Dimension, 2x10, 16, No. 1, common	17.75	17.25
Dimension, 3x3 to 4x12, No. 1, common	19.25	19.00
Dimension, 5x5 to 12x12, No. 1, common rough	17.25	16.75

The production of portland cement during May was 17,280,000 bbl. or 86.6 per cent of capacity. This compares with a total volume of shipments of 18,986,000 bbl., production being 3.5 per cent and shipments 12.6 per cent more than in May, 1927. Stocks at the end of May totaled 25,921,000 bbl., or 10.3 per cent more than at the end of May, 1927. Prices have been subject to change only at New Orleans where the quotation appearing in the table below is 10 cents lower. The prices are per barrel in carload lots not including package.

New York	$2.03	Minneapolis	$2 22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.40	Dallas	2 40
Chicago	2.05	San Francisco	2.41
Cincinnati	2.22	Montreal	1.41

Railway News

Briefly Told

The Saratoga & Encampment Valley, between Wolcott, Wyo., and Encampment, 44 miles, whose abandonment had been authorized by the Interstate Commerce Commission, will be continued in operation if the efforts of citizens residing along the line are successful. A committee has been formed to acquire title to the property and to turn it over to the Union Pacific without cost for operation by that road.

Revenue freight car loadings for the week ending June 16 totaled 1,003,292, the fourth week this year in which the million mark was reached. This was an increase of 7,332 cars over the preceeding week, but a decline of 13,059 cars as compared with the corresponding week in 1927, the greater part of the decrease being due to smaller loadings of coal. The cumulative total for the first 24 weeks of the current year amounted to 22,467,267 cars.

The threatened strike of the Brotherhood of Sleeping Car Porters, which had been set for June 8, was "postponed" upon the advice of William Green, president of the American Federation of Labor who said that "economic conditions are not favorable to a strike now. Public opinion has not been crystallized to approval of your demands." The United States Board of Mediation refused to recommend to President Coolidge the appointment of an emergency board of arbitration to attempt to settle the dispute.

The Depreciation Order, known as No. 15,100, issued by the Interstate Commerce Commission, which requires the railways to establish depreciation reserves for roadway and building accounts, has been modified by eliminating all reference to the latest date on which the steam railways shall file with the commission their estimates of composite percentage rates for use in depreciation accounting. In its modifying order the commission says that the computation of such rates may properly be deferred until it shall have entered its final order and set a new date for the submission of such data.

R. H. Aishton, president of the American Railway Association, who entered railway service in 1878 as an axeman on the Chicago & North Western, and who, after 17 years service in the engineering and maintenance departments, entered the operating department and later became president of the road, was presented with a gold cup at a dinner given at Atlantic City on June 14 by the executive committee of the Association of Railway Executives in commemoration of the fiftieth anniversary of his entering railway service and also of his sixty-eighth birthday on June 2.

The Southern Pine Association, on June 10, adopted a definition of dense long leaf yellow pine, which incorporates the yellow pine density rule, with the idea that such a rule would insure purchasers receiving what they desire when long leaf yellow pine is specified. The definition is as follows: "Long leaf dense pine timber and dimension shall be timber and dimension manufactured from long leaf pine trees and shall show not less than six annual rings to the inch and contain not less than one-third summer wood (measured in accordance with the density rule). Evidence of species shall be furnished by the manufacturer in the form of a grade mark on each piece or by a certificate upon demand."

The Atchison, Tokepa & Santa Fe has applied to the Interstate Commerce Commission for permission to acquire control of the Kansas City, Mexico & Orient, by the purchase of its capital stock. The K. C. M. & O. extends from Wichita, Kan., to Alpine, Tex., a distance of 735 miles, and in addition has a total of 222 miles of line in Mexico, the original plan having been to construct a trunk line from Kansas City, Mo., to Topolobampo, Mex., on the Gulf of California, with a connection from San Angelo, Tex., to the National Railways of Mexico at Del Rio, to form a short line to the City of Mexico. The completion of the original plan would require the construction of about 485 miles of line: 325 miles to fill the gaps on the Topolobampo line and 160 miles for the connection to Del Rio.

"Safety to the Utmost" is the slogan suggested by the Committee on Education of the Safety Section, A. R. A., in its circular to the railroads outlining its program for the month of July. The circular consists mainly of comparisons between 1923 and 1927, showing what has been accomplished in four years in the effort to reduce accidents 35 per cent in the seven years from 1923. This program means that a reduction of 20 per cent should have been made by the end of 1927, and the returns show that 76 roads have already attained a reduction of 35 per cent or more, while 43 others have made reductions from 20 per cent upward but less than 35 per cent. In view of what has been accomplished on these roads, all concerned are urged to keep up their enthusiasm in the work.

The Richmond division of the Pennsylvania, which recently lost its identity by being consolidated with the Cincinnati division, was noted for the number of former superintendents, who also had served in the engineering and maintenance of way departments, and later advanced to higher positions. Among these was Henry I. Miller, its first superintendent, who later served in executive positions on the Vandalia, the Chicago, Rock Island & Pacific, and the Chicago & Eastern Illinois. Another of its early superintendents was W. B. Leeds, who later became the multimillionaire tinplate king. Others in the list are George Le Boutillier and A. C. Watson, vice-president and chief engineer, respectively, of the Long Island; W. B. Wood, assistant to the general manager of the Western region, and F. J. Stimson, assistant chief engineer, maintenance of way of the Western region.

It seems that the engineers and maintenance of way men are wrong in thinking that the flanges of the car wheels have anything to do with keeping the cars on the rails. The following, which appeared as a syndicated feature in the newspapers, contains much that is important (if true) and will come as a distinct surprise to many who thought they knew their railroads.

"Many people think that a train is kept on the rails by the flange or rim that is on the inside edge of the wheel. This flange steadies the car but does not keep it on the rails. The rail is slightly rounded on top, as is the rim of the car wheel, so that the wheel does not rest squarely on the rail. The outer circumference of the wheel is smaller than the inner and the wheel rests on the inner slope of the rounded rail. In running, the wheels press outward because it is easier for them to run along the smallest edge and on top of the rail. By pushing outward and exerting the same force in opposite directions the wheels keep each other balanced and on the rails."

It is not likely that the railroads will leave the flanges off the car wheels without a full verification of this theory. If it is ever tried, the originator of the above explanation should have the honor of being a passenger on the car with which the experiment is made.

Construction News

The Alabama, Florida & Western's application for authority to build a line from Chipley, Fla., to Graceville should be denied, according to a proposed report by Examiner Malster, which has been made public by the Interstate Commerce Commission. The report says that if and when there develops the need for additional railroad facilities in the territory affected, the facilities should be provided by the Louisville & Nashville by the construction of a line from Graceville to Chipley or from Graceville to Cottondale.

The Atchison, Topeka & Santa Fe has awarded a contract to the Roberts & Schaefer Company, Chicago for the construction of an automatic electric engine coaling station at Pekin, Ill.

The Baltimore & Ohio has let a contract to the Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., for water treating plants at Layton, Griffin and Wildwood, Pa., at a cost of $45,000. A contract was also let to J. M. Cain, Baltimore, Md., for the construction of water treating plants at Point of Rocks and Brunswick, Md. The estimated cost of these facilities is approximately $62,000.

A contract has also been awarded to Bates & Rogers Construction Co., Cleveland, O., for the reconstruction of four bridges on the Ohio River branch. This work is expected to cost about $52,000.

The Bangor & Aroostook closed bids on June 15 for the construction of two coaling stations of 150- and 50-ton capacities at Northern Maine Junction, Me.

The Bessemer & Lake Erie has awarded contracts for work in connection with line changes and grade reductions between Filer, Pa., and Coolspring. Winston Brothers Company, Minneapolis, Minn., has received the contract for the grading and structural work between Filer and Pardoe, while a contract for grading Cozad cut and concrete work for an overhead highway bridge has been awarded to the Milliron Construction Company, Du Bois, Pa. The H. E. Culbertson Company, Cleveland, O., has received a contract for the balance of concrete and foundation work. The project is expected to cost approximately $198,500. This company has also closed bids for the construction of an undergrade crossing to eliminate four grade crossings at West Springfield, Pa. The estimated cost of this work is approximately $34,000.

The Canadian National plans the elimination of a grade crossing on its line near North Sydney, N. S. The project is expected to cost about $27,500.

The Canadian Pacific has awarded contracts for the construction of branch lines on the Western lines as follows: An extension on the Moose Jaw Southwesterly branch from mileage 109, which is 12 miles east of Val Marie, Sask., to mileage 146, 37 miles, to Foley Brothers, Inc., St. Paul Minn.; an extension of the Leader Southerly branch from Pennant, Sask., to a point 24 miles southwest, to W. A. Dutton, Winnipeg, Man.; an extension of the Fife Lake branch from Coronach, Sask., to a point 20 miles east, to Foley Brothers, Inc.; an extension of the Hak (Sask.)-Coderre branch to a point 12 miles east of Coderre, to Duff Flint & Co., Winnipeg.

This company has awarded contracts for the construction of 12 plate girder bridges, six truss bridges and three combined plate girder and truss bridges on the Revelstoke division between Field, B. C., and Revelstoke. The Canadian Bridge Company will construct 13 of the bridges and the Hamilton Bridge Company will construct 8. Five of the bridges will be fabricated by the Manitoba Bridge & Iron Works, seven by J. Coughlan and Sons, Vancouver, B. C., four each by the Dominion Bridge Company and the Hamilton Bridge Company and one by the Canadian Bridge Company. The new bridges will replace existing structures and will allow the operation of heavier locomotives on this division.

The provincial railway department of Alberta has approved the plans of this company for the construction of a line from Breton, Alta., the northern terminus of the recently acquired Lacombe & Northwestern, to Leduc, 41 miles. It is planned to receive tenders for the construction of 28 miles of this extension from Breton within a short time. The remaining 13 miles will be constructed in 1929.

The Canton & Carthage has applied to the Interstate Commerce Commission for authority to build and operate a line from Canton to Carthage, Miss., including 11 miles of track already built by the Pearl River Valley Lumber Company.

The Chesapeake & Ohio has awarded a contract for the construction of an addition to its yard at Martin, Ky., to T. C. Staples. With the construction of a water tank, coaling station and similar facilities, the cost of the improvement is estimated at $60,000.

The Chicago, Burlington & Quincy has let a contract to the Roberts & Schaefer Company, Chicago, for the construction of two-track electric cinder plants at Sterling, Colo., at Sheridan, Wyo., at McCook, Neb., and at Kansas City, Mo.

Chicago, Rock Island & Pacific has awarded a contract for the construction of a reinforced concrete and brick commissary building at Fifty-first street, Chicago, to replace a similar structure which was destroyed by fire, to Dwight P. Robinson & Co., Inc., New York, at a cost of about $200,000. The same company has been awarded a contract for the construction of a brick and steel car shop at Burr Oak, Chicago, at a cost of about $200,000.

The Cincinnati Union Terminal has engaged Fellheimer & Wagner, New York architects, to design the proposed Union passenger station at Cincinnati, Ohio. Work will start immediately on the preparation of plans for the station, a site for which has been selected in the Mill Creek Valley, facing Lincoln Park.

The Cleveland, Cincinnati, Chicago & St. Louis, in connection with the construction of the Cleveland (Ohio) Union Terminal, plans the extension of existing highway subways, the construction of several new overhead bridges, an addition to the roundhouse at Linndale, Ohio, and a new coaling station at the same point. Although the project has not yet been authorized this railroad contemplates the extension of its roundhouse and the construction of a repair shop at Bellefontaine, Ohio.

The Cleveland Union Terminals has awarded a contract for the construction of the station building proper and a number of viaducts in connection with the terminal development at Cleveland, Ohio, to the Aronberg-Fried Company, New York.

The Denver & Rio Grande Western will employ company forces in the construction of additional yard facilities at Pueblo, Colo., at a cost of approximately $19,000.

The Erie has let a contract to Arthur McMullen Co., New York, for additional yard facilities at Port Jervis, N. Y., at an estimated cost of $100,000.

A contract has been awarded to the De Hamil Construction Company, Cleveland, for the erection of a post-office building at Binghamton, N. Y., to be known as the Erie Terminal Post-office.

The Galveston, Houston & Henderson, the Houston Belt & Terminal, and the International-Great Northern will pay 75 per cent of the cost of a subway under their tracks at Houston, Tex., to connect Franklin boulevard with Navigation boulevard. The contract for the subway has been awarded to Walker & Elder, Houston, at a cost of about $260,000.

The Grand Trunk Western has been authorized by the Interstate Commerce Commission to build a 7-mile belt line in Pontiac, Mich., to cost approximately $647,000 exclusive of land.

A contract for the construction of additions and alterations to the 40-stall engine house at Durand, Mich., has been awarded to the Davis-Stuntz Company, Detroit, Mich.

The Illinois Central plans to enlarge its grain elevator at Omaha, Neb., by the addition of storage space for 1,000,000 bu. of grain.

The Kettle Valley has awarded a contract for realinement and reduction of grade at a point between Jura, B. C., and

Jellicoe to Robertson Brothers, Inc., Vancouver, B. C.

The Keystone Wood, Chemical & Lumber Corporation has filed a petition with the New York Public Service Commission for permission to construct a railroad between the towns of Greig and Webb, N. Y. The line is planned for the opening of a timber tract and will be used exclusively for hauling lumber.

The Louisiana & Arkansas has let a contract for the construction of an addition to the passenger station at Shreveport, La., to K. C. Wilson, Shreveport.

The Louisville & Nashville plans the construction at Mobile, Ala., of a 12-track yard with a turntable, 17-stall engine house, coaling station, cinder pits and similar engine terminal facilities and a combination boiler, blacksmith and machine shop adjoining the roundhouse. The yard will be located within the northern limits of Mobile immediately south of Three Mile creek. Grading will be done by the Alabama State Docks Commission with dredged material pumped from harbor slips, track work will be undertaken by company forces, while building work will be contracted when plans are completed.

The Maysville Bridge Company plans the construction of a railroad between Dayton, Ohio, and Maysville, Ky., about 90 miles, to serve a coal region. Permission has been obtained for the construction of a bridge across the Ohio River at Aberdeen, Ohio. It is planned to apply to the Interstate Commerce Commission for permission for construction immediately.

The Midland Valley has awarded to G. D. Morrow & Son, Tulsa, Okla., for the construction of a highway subway under its tracks at East Sixth street, Tulsa, at an estimated cost of $130,000.

The Missouri-Kansas-Texas has let a contract for a change of line and the reduction of grade from 0.7 per cent to 0.5 per cent at Wilsonton, seven miles south of Parsons, Kan., to the C. J. List Construction Company, Kansas City, Mo. The cost of this work is estimated at about $159,000.

The Missouri Pacific has awarded a contract to the List & Weatherly Construction Company, Kansas City, Mo., for the construction of four sheep pens and accompanying chutes, a grain elevator, a feed-mixing plant and an office building at Dodson, Mo., at a cost of about $400,000. Three of the pens will have outside dimensions of 130 ft. by 1,000 ft. and one pen will have dimensions of 400 ft. by 600 ft. These pens will replace the present sheep pens at Leeds, Mo., which will be abandoned to permit the construction of an automobile assembly plant by the Chevrolet Motor Company. A contract for the construction of yard tracks to serve the automobile plant has been awarded to Ross & Wogan, Kansas City. The total cost of the yard will be about $250,000.

This company has awarded a number of contracts for the raising of tracks above flood water stage on its line between Little Rock, Ark., and Texarkana as follows: to the Winston Brothers Company, Minneapolis, Minn., for raising track near Little Rock; to J. H. Walker, Little Rock, for raising track near Haskells, Ark., and at two points near Traskwood, Ark.; and to Harvey Brown, Little Rock, for raising track near Donaldson, Ark. The bridge work on the raising of track near Benton, Ark., will be undertaken by the List & Weatherly Construction Company, Kansas City, Mo.

The Monogahela has awarded a contract to A. Guthrie & Co., Inc., St. Paul, Minn., for the construction of an extension of the Chartiers Southern from Waynesburg, Pa., to Mather, 7 miles. This project will involve the excavation of 500,000 cu. yd. of material, most of which is rock, and the driving of a 1000-ft. tunnel. The cost of this portion of the work, which includes grading and the construction of culverts and the concrete substructures for bridges, will be about $750,000.

The New York Central has awarded contracts to Merritt, Chapman & Scott, Inc., New York, for the construction of an additional intake at Glenwood power station, Yonkers, N. Y., and to Miller-Blyth, Inc., New York, for the construction of a substation at Philipse Manor, N. Y. Contracts also have been awarded to the John Johnson Construction Company, Buffalo, N. Y., for electrical and platform work at Central Station, Buffalo.

The Northern Pacific has awarded a contract to the Ogle Construction Company, Chicago, for the erection of a 500-ton electrically-operated steel coaling station at Glendive, Mont.

The Oregon, California & Eastern has awarded contracts for the construction of an extension from Sprague River, Ore., to Bly, 26 miles. A contract for the grading of the 19 miles immediately east of Sprague River has been let to Johnson & Johnson, while a contract for the grading on the nine miles of line west of Bly has been let to Morgan Vicory.

The Oregon-Washington Railroad & Navigation Company has requested bids for the construction of a blacksmith shop and an apprentice school building at Albina yard, near Portland, Ore., and the remodeling of an iron house, a flue rattler building, and welding shed and a dynamo and switch house at the same point.

The Pennsylvania has let a contract to Brann & Stuart Co., Philadelphia, Pa., for the reconstruction of the Forty-first street bridge over its tracks at a cost of $130,000. Sinclair & Grigg, Philadelphia, have been awarded a contract for the construction of a steel and brick freight delivery warehouse 92 ft. by 460 ft. at Tioga and D streets, Philadelphia, at a cost of $260,000.

A contract has been let to Allen N. Spooner & Son, Inc., New York, for the construction of a freight delivery warehouse at Kearny, N. J. This warehouse will be of steel and concrete construction and is expected to cost approximately $190,000. The John F. Casey Co., Pittsburgh, Pa., has received a contract from this road for concrete paving and curbing for driveways in the new produce yard at Pittsburgh, Pa., at an estimated cost of $45,000.

A contract for grading and masonry work in connection with line changes and bridge reconstruction, west of Carnegie, Pa., has been awarded to Ferguson & Edmonds, Pittsburgh, Pa. The project is expected to cost approximately $150,000. A contract was also let to the Dresser Company, Cleveland, O., for the erection of a new station at Wilson, Pa.

The Pere Marquette has applied to the Interstate Commerce Commission for authority to construct lines from Green Oak to Wixom, 7.8 miles, and from Pontiac to Richmond, 30 miles, all in Michigan. The company has pending an application for authority to build an extension from Wixom to Pontiac and a belt line at Pontiac and states that the present application, with the construction proposed in the pending application, will enable it to shorten its distance between Chicago and Buffalo approximately 35 miles. It plans later to apply for a certificate for a line from Grand Junction to Woodbury.

The Reading has awarded contracts to Irwin & Leighton, Hughes-Foulkrod Co., and the Shoemaker Bridge Co., Philadelphia, for work in connection with its new North Broad Street station in Philadelphia. The first company received the contract for the erection of the building, the second for platform, grading, masonry and appurtenant work while the work awarded to the third is for steel work in connection with alterations to bridges involved in the project at Cumberland and 13th streets. The estimated cost is approximately $2,000,000.

The Richmond, Fredericksburg & Potomac has let a contract for the construction of a bridge over Powell's Creek, south of Washington, D. C., to James S. McCormick Co., Easton, Pa.

The Rutland has awarded a contract to the Railway Engineering & Construction Co., Boston, Mass., for the construction of the substructure of a bridge over the Winooski river at Burlington, Vt. Bids were recently closed for the construction of the superstructure. The work is expected to involve an expenditure of approximately $227,500, of which $50,000 is the estimated cost of the substructure involved in the contract awarded.

The Seaboard Air Line contemplates the construction of a new freight depot with modern facilities at Savannah, Ga.

Detailed plans for the structure have not yet been developed.

The St. Louis-San Francisco plans the construction of a passenger station at Pensacola, Fla., on the Muscle Shoals, Birmingham & Pensacola, to replace the station now in use at that point.

This road, together with the Missouri Pacific and the Kansas City Southern, will be required to share in the cost of a viaduct over their tracks at Winner road, Kansas City, Mo., according to a recent court decision. The total cost will be $1,900,000, of which the city will bear 50 per cent, the St. L.-S. F. and the M. P. 12 per cent each, and the K. C. S., 8 per cent.

The Southern Pacific has announced plans for the construction of a bridge over Carquinez strait between Suisun Point, Cal., and Army Point, northeast of San Francisco, to replace a train ferry service now in operation between Benicia and Port Costa and shorten the time of trains between San Francisco and points north and east by 20 to 35 minutes. The bridge will be double track and will have a total length of 5,597 ft. including a viaduct 750 ft. long, 10 spans each 408 ft. long, one span 384 ft. long and one lift span 327 ft. long.

The Terminal Railroad Association of St. Louis was denied permission by the Board of Public Service of St. Louis, Mo., on June 14, for the enlargement and improvement of the St. Louis Union Station and its facilities. The board held that these improvements, which will cost about $4,000,000, are too extensive to be approved by the city under a construction permit and that the Board of Aldermen should adopt an ordinance, inasmuch as the request for the use of certain streets and alleys amounted to permanent vacation.

The Toronto Terminal closed bids on June 12 for the construction of an express and office building for the Canadian Pacific at Toronto, Ont., and on June 7 for the construction of an express and office building for the Canadian National at the same point.

The Wabash expects to take bids within the near future for the construction of a double track viaduct over North Broadway, St. Louis, Mo., at a cost of about $89,000. The city of St. Louis has agreed to pay the Wabash $40,000 in damages incident to the replacement of the present structure to make way for the widening of the street from 60 ft. to 80 ft.

This company also expects to take bids soon for the construction of a fruit auction building at Carr and Second street, St. Louis, at a cost of about $850,000. The building, which will be 780 ft. long and 56 ft. wide, will include a three-story office building which will have outside dimensions of 82 ft. by 140 ft. The structure will be served by two tracks which will permit the unloading of 75 cars at one time.

Supply Trade News

General

The Joseph Dixon Crucible Company, Jersey City, N. J., has moved its Chicago sales office to the Builders building, Wacker Drive and La Salle street.

The Bucyrus-Erie Company, South Milwaukee, Wis., plans the construction of a two-story addition, 65 ft. by 180 ft., to be used as a pattern shop and storage vault.

The Manning Abrasive Company, Inc., Troy, N. Y., and **Herman Behr & Co., Inc.,** Brooklyn, N. Y., manufacturers of sand paper and other abrasive products, have consolidated under the name of the Behr Manning Corporation. The factories in Brooklyn and Troy will continue in operation as heretofore.

The A & H Corporation, Chicago, has been organized to engage in the general railway and industrial supply business. This concern will take over the sales and service of the E. A. Lundy Company in the western territory, and will also handle all Aldobilt products. **C. F. Hopkins,** formerly assistant to the president of the E. A. Lundy Company, and **R. B. Arnold,** formerly western manager of the signal division of that company, have been elected vice-presidents of the new company.

Personal

M. C. M. Hatch, Technology Chambers, 8 Irvington Street, Boston, Mass., has been appointed representative in the New England territory, for the Armspear Manufacturing Company, New York.

George A. Gothberg has been appointed manager of railroad sales with headquarters at 10 North Fox Street, Chicago, for the General Fireproofing Company, Youngstown, Ohio, succeeding **E. L. Lefler,** resigned.

L. O. Gunderson, formerly chemical engineer of the Chicago & Alton, has been elected president of the Electro Chemical Engineering Corporation, Chicago, which has been organized to manufacture water softening and treating plants.

Frank J. Johnson, senior partner and one of the founders of the American Hoist & Derrick Company, St. Paul, Minn., has purchased the partnership interest of **W. O. Washburn** in that concern and the business has been incorporated under the same name with **Frank J. Johnson** as president and treasurer, **Howard S. Johnson** as vice-president in charge of sales and **Frederic Crosby** as vice-president in charge of production.

George F. Schelsinger, director of highways of Ohio, has resigned to become chief engineer and managing director of the National Paving Brick Manufacturers' Association, the appointment being effective on July 1. The headquarters of the association will be moved from Chicago to Washington, D. C.

D. A. Merriman, general manager of sales of the American Steel & Wire Company, Chicago, has been elected vice-president and general manager of sales. **H. B. McGuire,** assistant manager of the sales office at Detroit, Mich., has been promoted to assistant to the vice-president and general manager of sales.

Blaine S. Smith, vice-president of the Universal Portland Cement Company, with headquarters at Chicago, has resigned to become president of the Pennsylvania Dixie Cement Corporation, with headquarters at New York, succeeding **John A. Miller,** who has been made chairman of the board. Mr. Smith entered railway service in the traffic department of the Chicago & North Western at Chicago and became connected with the Universal Portland Cement Company in 1908. By successive promotions, he advanced to the position of general sales manager in 1915 and later was elected vice-president. Mr. Smith has taken an active part in the proceedings of the Portland Cement Association, which he served for two years as vice-president and later as its president for the same period.

R. J. McComb, western manager of the Q. & C. Company, New York, with headquarters at Chicago, has resigned to become sales manager of the Woodings Forge & Tool Company, Vernon, Pa. Mr. McComb was born at New Castle, Pa., and was educated at Pennsylvania State College. He entered railway service in 1905 with the Wheeling & Lake Erie, where he later was promoted to engineer maintenance of way and superintendent of construction. Mr. McComb left railway service in 1918 to become affiliated with the Q. & C. Company, with which company he was associated until his recent appointment as sales manager of the Woodings Forge & Tool Company.

R. J. McComb

Personal Mention

General

Harry J. McCall, division roadmaster on the Northern Pacific, with headquarters at Jamestown, N. D., has been promoted to trainmaster, with headquarters at Mandan, N. D.

John Wagner, supervisor on the Philadelphia, Germantown & Norristown line of the Reading, with headquarters at Philadelphia, Pa., has been appointed industrial agent, with headquarters at the Reading terminal, Philadelphia.

Harold A. Hobson, assistant superintendent of the New York division of the Pennsylvania, with headquarters at Jersey City, N. J., whose early railway training was in the engineering department, has been promoted to superintendent of the Logansport division, with headquarters at Logansport, Ind. Mr. Hobson was born on April 3, 1886, at Flushing, Ohio, and was educated at Mt. Union College at Mt. Union, Ohio. He entered railway service during his school vacation in 1904 with the engineering department of the Baltimore & Ohio on preliminary surveys, location and construction in southeastern Ohio and was engaged in similar work with that road during his vacations in 1905 and 1906. He entered the service of the Pennsylvania on May 28, 1907, as an assistant on an engineer corps on the construction of the Bedford yard near Cleveland, Ohio. Because of a reduction in forces, Mr. Hobson left railway service in the latter part of the same year, returning to the Pennsylvania on May 1, 1909,

Harold A. Hobson

as an engineering assistant, acting in various capacities in the maintenance of way department until 1914, when he was promoted to pilot engineer in the valuation department, which was organized at that time. He served in the United States Army from 1917 to 1919, and on May 1, 1920, entered the operating department as an acting assistant trainmaster, later serving in various capacities in both the maintenance of way and transportation departments at Pittsburgh, Pa., New Castle, and Cleveland, Ohio. He was appointed assistant trainmaster at Canton, Ohio, on April 16, 1923, trainmaster of the Renovo division on November 16, 1925, and assistant superintendent of the New York division on March 10, 1927. He was holding the latter position at the time of his recent promotion to superintendent of the Logansport division.

Eugene C. Bagwell, operating assistant to the vice-president of the Seaboard Air Line, with headquarters at Savannah, Ga., who is an engineer by education and experience, has been promoted to general manager, with

Eugene C. Bagwell

headquarters in the same city. Mr. Bagwell was born on October 3, 1884, at Raleigh, N. C., and graduated from the North Carolina State College in 1904. He entered the service of the Seaboard Air Line in August of the same year as a construction engineer, remaining in that capacity until March, 1908, when he became superintendent of the Charlotte Harbor & Northern (now a part of the Seaboard Air Line). He returned to the Seaboard in September, 1909, as a resident engineer, and in April, 1910, was promoted to principal assistant engineer, serving in this capacity until April, 1914, when he was promoted to assistant to the president, with headquarters at Norfolk, Va. In 1917, he entered the operating department as division superintendent at Charleston, S. C., and in February, 1925, was promoted to general superintendent, with headquarters at Savannah, Ga. Mr. Bagwell was promoted to operating assistant to the vice-president in February, 1928, with headquarters at Savannah, which position he was holding at the time of his recent promotion to general manager.

Engineering

H. E. Beard, assistant chief engineer of the Kansas City, Mexico & Orient, with headquarters at Wichita, Kan., has been promoted to acting chief engineer, with headquarters at the same point.

James N. Ewing, assistant to the division engineer of the Sunbury division of the Pennsylvania, with headquarters at Sunbury, Pa., has retired from active duty after a continuous service of 40 years with that company.

H. M. Swope, acting division engineer of the Eastern division of the Atchison, Topeka & Santa Fe, with headquarters at Emporia, Kan., has been promoted to division engineer of the same division, with the same headquarters.

A. F. Dyer, instrumentman on the Illinois Central, has been promoted to assistant engineer, with headquarters at Dubuque, Ia., succeeding **T. B. Grear,** whose promotion to supervisor, with headquarters at LaSalle, Ill., is noted elsewhere in this issue.

A. O. Wilson, division engineer on the Seaboard Air Line, with headquarters at Jacksonville, Fla., has been transferred to Savannah, Ga., to succeed **O. F. McNairy,** who has been transferred to the North Florida division, with headquarters at Jacksonville.

Clifford A. Betts, office engineer for the Moffatt Tunnel Commission, Denver, Colo., who was in responsible charge of all engineering work in connection with the construction of the tunnel since 1925, has resigned to engage in engineering work in connection with the construction of the Owyhee dam in Oregon.

John C. Nichols, a draftsman in the bridge department of the chief engineer's office of the Louisville & Nashville at Louisville, Ky., has been promoted to assistant engineer in the miscellaneous department, with headquarters at the same point, to succeed **Edward Wise, Jr.,** whose promotion to special engineer was noted in the June issue.

Maurice Coburn, assistant to the division engineer of the Cincinnati division, with headquarters at Cincinnati, Ohio, has been promoted to assistant to the engineer of maintenance of way of the Northwestern general division of the Western region, with headquarters at Chicago. **G. R. Barry,** superintendent of the recently abolished Richmond division, with headquarters at Richmond, Ind., has been appointed assistant to the engineer of maintenance of way of the Southwestern general division, with headquarters at Indianapolis, Ind. **J. C. Poffenberger,** division engineer of the Conemaugh division, with headquarters at Pittsburgh, Pa., has been transferred to the Middle division, with headquarters at Altoona, Pa., succeeding **R. P. Graham,** whose promotion to superintendent of the Maryland division was noted in the June issue.

Andrew R. Ketterson, whose appointment as assistant engineer of bridges on the Canadian Pacific, with headquarters at Montreal, Que., was noted in the June issue, was born on June 24, 1881, at Greenock, Scotland, and graduated from the Royal Technical

College, Glasgow, Scotland, in 1902. He entered the service of the Canadian Pacific in May, 1907, as a bridge inspector, and in 1909 he became a draftsman in the bridge department. In 1911 he was promoted to assistant engineer and held this position until 1916, when he entered the Canadian Expeditionary Forces in France as a major. During his overseas service, he received two citations and was awarded the Distinguished Service Order. In 1919 he reentered the service of the Canadian Pacific as an assistant engineer in the office of the chief engineer, and served in this capacity until May 1, 1928, when he was appointed assistant engineer of bridges.

Wayne J. Burton, assistant valuation engineer of the Missouri Pacific, with headquarters at St. Louis, Mo., has been promoted to assistant to the chief engineer, with headquarters at the same point. Mr. Burton was born in Berrien county, Mich., on November 29,

Wayne J. Burton

1882, and was educated at Purdue University, where he graduated in 1903. He entered railway service in the same year in the engineering department of the Baltimore & Ohio, and in June, 1905, became an assistant roadmaster on the Missouri Pacific, with which road he has been connected continuously since that time. He was later promoted to assistant engineer and in 1907 was further promoted to division engineer, with headquarters at Pueblo, Colo. Following this he was transferred to St. Louis, where he served successively as division engineer, general roadmaster and designing engineer. Mr. Burton was promoted to assistant valuation engineer in 1914, which position he was holding at the time of his promotion to assistant to the chief engineer on June 1.

Ernest R. Logie, whose promotion to division engineer on the Belleville division of the Canadian National, with headquarters at Belleville, Ont., was noted in the May issue, was born on Aug. 16, 1886, at Chatham, N. B. After graduating from the University of New Brunswick, he entered the service of the Grand Trunk Pacific in 1908, with headquarters at Winnipeg, Man. During 1909 and 1910 he was with the Bangor & Aroostook, following which he entered the service of the Algoma Central & Hudson Bay, where he remained until 1912. From 1912 to 1917 he acted as resident engineer of construction on the Canadian Northern Ontario Railway and the Toronto Suburban Railway (now parts of the Canadian National), and in 1917, he became resident engineer on the Toronto, Hamilton & Buffalo on yard and double-tracking work. In 1919, he became a resident engineer in the maintenance of way department of the Canadian National. In 1920, Mr. Logie was temporarily appointed division engineer and in December of the same year was made an assistant engineer, in which position he served on the Ottawa division and on the Southern Ontario district. At the time of his recent promotion to division engineer, Mr. Logie was an assistant engineer in the office of the district engineer at Toronto.

C. A. Hopkins, whose appointment as valuation engineer of the Chicago & Illinois Midland with office at Springfield, Ill., was noted in the June issue, was born on August 20, 1887, at Steubenville, Ohio. Mr. Hopkins entered railway service in 1907 as a resident engineer on the construction of the Carolina, Churchfield & Ohio (now the Clinchfield) near Johnson City, Tenn., and during the following eight years served in the engineering departments of the Chicago, Milwaukee & St. Paul (now the Chicago, Milwaukee, St. Paul & Pacific), the Denver & Salt Lake, as locating engineer of the Montezuma & Western (now abandoned) and was also engaged in real estate development and municipal engineer at various times during that period. Mr. Hopkins returned to the Milwaukee in 1917 as an assistant engineer on valuation work and from April, 1918, to March, 1924, he was engaged in valua-

C. A. Hopkins

tion and maintenance, and also in electrification studies on that road. He was secretary and treasurer of the Pomeroy Paper Products Company, Chicago, from 1924 until July, 1926, when he became staff engineer of the Roberts-Pettijohn-Wood Corporation, Chicago, engaged in railway appraisal work, which position he was holding at the time of his recent appointment as valuation engineer of the Chicago & Illinois Midland.

F. S. Hales, engineer of track of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has been promoted to engineer of the Cleveland Terminal Improvements, with headquarters at the same point, and **A. M. Clark,** division engineer of the Ft. Wayne-Chicago divisions of the Nickel Plate district, with headquarters at Ft. Wayne, Ind., has been promoted to engineer of track, with headquarters at Cleveland, to succeed Mr. Hales. **Paul McKay,** assistant district engineer of the Lake Erie & Western district, with headquarters at Indianapolis, Ind., has been promoted to division engineer, with headquarters at Ft. Wayne, to succeed Mr. Clark, and **Harold F. Whitmore** has been appointed assistant district engineer, with headquarters at Indianapolis, to succeed Mr. McKay.

Mr. Hales was born on April 13, 1893, at Wilson, N. C., and was educated at Cornell University where he graduated in 1916. He entered railway service in June of the same year as an instrumentman on grade-crossing elimination on the New York, Chicago & St. Louis, and later served as a draftsman on bridge and track layouts. He entered military service on June 26, 1918, and returned to the Nickel Plate on September 26, 1918, as a designer on grade-crossing elimination. On November 1, 1919, he became an assistant to the corporate chief engineer on work connected with federal control settlements. He was promoted to assistant engineer of design on April 1, 1920, and became an assistant engineer in the maintenance of way department on April 15, 1924. This was followed in August of the same year to his promotion to engineer of track of the Nickel Plate district. In May, 1925, his jurisdiction was extended to include the Lake Erie & Western district, and in January, 1927, it was further extended to include the entire Nickel Plate system.

Track

T. B. Grear, assistant engineer on the Illinois Central, with headquarters at Dubuque, Ia., has been promoted to supervisor, with headquarters at LaSalle, Ill., succeeding **L. Wallom,** who has left the service temporarily.

George M. Brum, roadmaster on the Chicago, Rock Island & Pacific with headquarters at Shawnee, Okla., has been assigned to other duties, on account of his former territory having been incorporated with other roadmasters' districts.

Raymond Westcott, acting supervisor on the Reading, with headquarters at Olney, Pa., has been promoted to supervisor at the same point, succeeding **James F. Sherron, Jr.,** who has been transferred to the Philadelphia, Germantown & Norristown line with headquarters at Philadelphia, Pa., to take

the place of **John Wagner**, whose appointment as industrial agent is noted elsewhere in this issue.

William G. Ashworth, roadmaster on the Northern Pacific, with headquarters at Jamestown, N. D., has been promoted to division roadmaster, with headquarters at the same point, to succeed Harry J. McCall, whose promotion to trainmaster, with headquarters at Mandan, N. D., is noted elsewhere in this issue.

John B. Bramlett, section foreman on the Louisville & Nashville at Blue Ridge, Ga., has been promoted to supervisor with jurisdiction between Cherry Log, Ga., and Marietta. Mr. Bramlett was born at Ellijoy, Ga., on January 31, 1889, and entered the service of the L. & N. as a section laborer on August 1, 1905. He was promoted to apprentice foreman on July 1, 1913, and to section foreman on May 1, 1915, which latter position he was holding at the time of his recent promotion to supervisor.

W. J. Gilbert, assistant to the division engineer of the Conemaugh division of the Pennsylvania, has been promoted to supervisor on the same division, with headquarters at Verona, Pa., succeeding **G. F. Mathey. M. C. Bitner**, assistant on engineer corps on the Panhandle division, has been promoted to assistant supervisor on the Renovo division, with headquarters at Kane, Pa., to succeed **N. D. Runkle**, deceased.

Irvin E. Long, whose promotion to track supervisor on the Pennsylvania, with headquarters at Struthers, Pa., was noted in the May issue, was born on July 23, 1887, at Coleman, Pa. After attending Franklin & Marshal Academy in 1910 and 1911, he entered Pennsylvania State College, from which he graduated in 1915. Mr. Long entered the service of the Pennsylvania on December 20, 1915, holding various positions in the engineering department prior to his recent promotion to supervisor.

Bridge and Building

John J. Taylor, superintendent of bridges, buildings and water service of the Kansas City Southern system, with headquarters at Texarkana, Tex., has been retired on a pension. Mr. Taylor was born on November 14, 1861, at Coffeeville, Miss., and entered railway service in 1884 as a section laborer on the East Line (now a part of the Louisiana Railway & Navigation Company). In the following year he became an extra gang foreman on the St. Louis Southwestern and in 1887 entered the bridge and building department of that road, where he served successively as a laborer, carpenter and assistant foreman. He was promoted to bridge and pile driver foreman in 1889 and remained in that position until March, 1902, when he was appointed general foreman of bridges, buildings and water service on the Southern division of the Kansas City Southern, with headquarters at Texarkana. Mr. Taylor was promoted to superintendent of bridges, buildings and water service of the system in 1904, which position he was holding at the time of his recent retirement.

Purchasing and Stores

G. E. Bacheller has been appointed purchasing agent of the Intermountain, with headquarters at Boise, Idaho.

J. V. Anderson, assistant district storekeeper on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Minneapolis, Minn., has been promoted to district storekeeper at Miles City, Mont., where he succeeds **D. B. Rivers**, who has been transferred to Minneapolis, to take the place of **George T. Richards**, resigned.

Russell J. Stackhouse, general storekeeper of the Reading, with headquarters at Reading, Pa., has retired under the pension regulations after 42 years of service with that road and **William H. Morris**, assistant general storekeeper, with headquarters at the same point, has been promoted to general storekeeper.

R. J. Gable, division storekeeper on the Illinois Central, with headquarters at Clinton, Ill., has had his jurisdiction extended to include the Indiana division, and **G. F. Ohden**, formerly storekeeper of that division, with headquarters at Mattoon, Ill., has been assigned to other duties. Mr. Gable will also have under his jurisdiction materials for all departments on the Illinois division previously handled by the Burnside (Ill.) general storehouse. The jurisdiction of **E. S. Shapland**, division storekeeper, with headquarters at Waterloo, Iowa, has been extended to include the Wisconsin division and **F. L. Rhynders**, formerly storekeeper at Freeport, Ill., has been assigned to other duties.

Obituary

John Asbury Byrd, track supervisor on the Louisville & Nashville, with headquarters at Etowah, Tenn., died on April 28, at the age of 71.

Frank Neher, assistant engineer on the Missouri Pacific until his retirement from active service in 1918, died at his home in Washington, Mo., on June 12 at the age of 71 years. During his service with the Missouri Pacific, Mr. Neher had charge of the construction of the freight terminals at Dupo, Ill.

Charles M. Roy, formerly assistant supervisor of bridges and buildings on the Louisville & Nashville, with headquarters at Birmingham, Ala., died in a hospital in that city on June 13, following an operation. Mr. Roy was 59 years of age and retired in 1926 on account of ill health, after a service of 35 years with the L. & N.

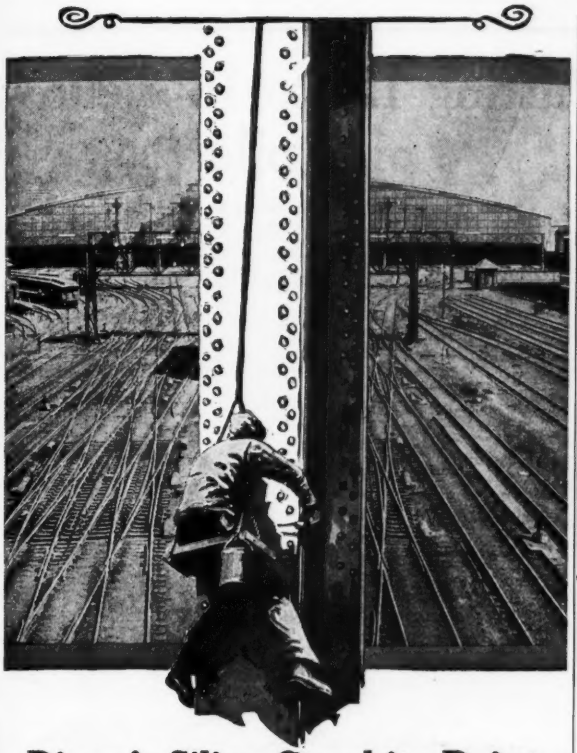
Hughey Lafayette Tucker, supervisor of bridges and buildings on the Louisville & Nashville, with headquarters at Montgomery, Ala., died in a hospital in that city on May 14, after a brief illness.

Joseph K. Choate, vice-president of the J. G. White Management Corporation, New York, whose early training was in railway maintenance and construction, died at San Francisco, Cal., on June 20, at the age of 74 years.

Neal McNabb, former roadmaster on the Michigan Central, who retired on a pension in 1923 on account of failing eyesight, after a continuous service of 47 years with that road, died on April 10, at his home in Grand Rapids, Mich.

M. Larson, chief engineer of the Railroad Commission of Wisconsin since 1913, died at Madison, Wis., on June 9. Prior to his taking that position, Mr. Larson had been connected with the engineering departments of various railroads, entering that service in 1902 as a transitman on preliminary surveys for the Alaska Railway. He later served as assistant resident engineer of the National Railways of Mexico, and as chief engineer of the Huatusco & Cordoba in Mexico. Mr. Larson was real estate engineer of the Chicago & Alton for three years, and was with the valuation department of the New York Central for a year.

John Bennington Berry, formerly chief engineer of the Union Pacific and of the Chicago, Rock Island & Pacific, died at his summer camp at Three Lakes, Wis., on June 22, at the age of 76 years. Mr. Berry was born on December 14, 1851, at Paterson, N. J., and was educated at the Brooklyn Polytechnic Institute. He entered railway service in 1874 as an assistant engineer on the Chicago & North Western, where, by successive promotions, he was advanced to division engineer on the Wisconsin division, and later served in the same capacity on the Galena division. In 1893, he was promoted to chief engineer of what was known as the Trans-Missouri Lines of the Chicago & North Western, which comprised the Fremont, Elkhorn & Missouri Valley and the Sioux City & Pacific (now parts of the C. & N. W.), with headquarters at Omaha, Neb. Mr. Berry was appointed chief engineer of the Union Pacific in 1898, with headquarters at Omaha, and during his service with that road was directly responsible to E. H. Harriman, chairman of the board, for the line and grade revision program undertaken about 1900. Mr. Berry resigned from the Union Pacific on November 10, 1905, to become chief engineer of the Chicago, Rock Island & Pacific, with headquarters at Chicago, and in March, 1913, was promoted to assistant to the president, with headquarters in the same city. During 1911 and 1912, he was also supervising engineer of the St. Louis-San Francisco. In 1914 he left the Rock Island to enter consulting engineering practice as a member of the firm of Berry, Howard & Roberts at Chicago.



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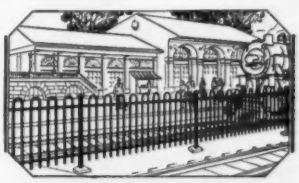

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Northwest Engineering Co.

Drains, Perforated
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

Drills, Earth
Buda Co.

Drills, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works

Drill Steel, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Track
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.

Dump Cars
Jordan Co., O. F.
Koppel Industrial Car & Equip. Co.
Magor Car Corp.

Dynamite
DuPont de Nemours & Co. Inc., E. I.

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Electric Tamper & Equipment Co.
Northwestern Motor Co.
Syntron Co.

Electric Snow Melters
Lundie Engineering Corp.
Q. & C. Co.

Engines, Gasoline
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Motor Car
Buda Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Oil
Buda Co.
Chicago Pneumatic Tool Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.

Excavators
American Hoist & Derrick Co.
Northwest Engineering Co.

Explosives
DuPont de Nemours & Co., Inc., E. I.

Fences
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association
Q. & C. Co.

Fence, Fabric
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

Fence Posts
Anchor Post Fence Co.
Maintenance Equipment Co.
Massey Concrete Products Corp
Page Fence Association
Prendergast Co.
Q. & C. Co.

Fibre Angle Pieces, Bushings, Etc.
Q. & C. Co.

Fibre Insulation
Q. & C. Co.

Flange Lubricator
Maintenance Equipment Co.

Flangers, Snow
Q. & C. Co.

Floor Coverings
Lehon Co.

Forgings
Bethlehem Steel Co.

Frogs
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Inc., Wm.

Gages, Measuring
Lufkin Rule Co.

Gages, Pressure Gas
Oxweld Railroad Service Co.

Gas, Acetylene
Oxweld Railroad Service Co.

Gates, Drainage
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

Grading Machinery
American Hoist & Derrick Co.

Graphite
Dixon Crucible Co., Jos.

Grinders, Portable
Buda Co.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Guard Rails
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Carnegie Steel Co.
Q. & C. Co.
Ramapo Ajax Corp
Wharton Jr. & Co., Wm.

Guard Rail Clamps
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Hammers, Chipping, Sealing and Calking
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hammer Drills
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hammers, Forge
Sullivan Machinery Co.

Hammers, Riveting
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hand Car Bearings
Timken Roller Bearing Co.

Head Drains, Perforated
Central Alloy Steel Corp.

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Hoisting Machinery
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Hoists, Air Motor
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hose
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

House Lining
Lehon Co.

Ice Cutters
Jordan Co., O. F.

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Inspection, Engineering
Hunt Co., Robert W.

Insulated Rail Joints
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Insulating Material
Lehon Co.

Jacks, Bridge
Buda Co.
Kalamazoo Railway Supply Co.

Jacks, Track
Buda Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

Joints, Compromise
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Joint Fastenings
Illinois Steel Co.

Joints, Rail
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

Joints, Step
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.

Junction Boxes
Massey Concrete Products Corp.

Knuckles, Emergency
Q. & C. Co.

Liners, Track
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Rail Joint Co.

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National Lock Washer Co.
Reliance Manufacturing Co.

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National Lumber Mfrs. Assn.
Southern Cypress Mfrs. Ass'n.

Manganese Track Work
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Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.

Mile Posts
Massey Concrete Products Corp.

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National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Illinois Steel Co.

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Out Houses
Massey Concrete Products Corp.

Oxygen
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Oxy-Acetylene Welding Equipment
Oxweld Railroad Service Co.

Paint
Aluminum Co. of America.
Dixon Crucible Co., Jos.
DuPont de Nemours & Co. Inc., E. I.

Paint, Metal Protecting
Aluminum Co. of America.
Dixon Crucible Co., Jos.

Pavement Breakers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Pile Drivers
American Hoist & Derrick Co.
Ingersoll-Rand Co.
Industrial Brownhoist Corp.

Piling
Carnegie Steel Co.
Jennison-Wright Co.
Massey Concrete Products Corp.

Pipe, Cast Iron
American Casting Co.
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe Carriers
Massey Concrete Products Corp.

Pipe, Concrete
Massey Concrete Products Corp.

Pipe, Corrugated
Armco Culvert Mfrs. Assn.

Pipe Joint Compound
Dixon Crucible Co., Jos.

Pipe, Sewer
American Casting Co.
Armco Culvert Mfrs. Assn.
Central Foundry Co.
Massey Concrete Products Corp.

Plates, Miscellaneous
Ramapo Ajax Corp.

Platforms, Station
Kentucky Rock Asphalt Co.
Natural Rock Asphalt Corp., Inc.
Ohio Valley Rock Asphalt Co.

Poles
Jennison-Wright Co.
Massey Concrete Products Corp.

Posts, Concrete, Fence, Mile, Etc.
Prendergast Co.

Posts, Fence
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Posts, Bumping
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Post Hole Diggers
Buda Co.

Powders
DuPont de Nemours & Co. Inc., E. I.

Power Plants, Portable
Electric Tamper & Equipment Co.
Northwestern Motor Co.
Syntron Co.

Preformed Track Pavement
Carey Co., Philip

Preservation, Timber
Jennison-Wright Co.

Products, Gas
Oxweld Railroad Service Co.

Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston, Plunger, Rotary, Sump
American Well Works
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Layne & Bowler, Inc.
Sullivan Machinery Co.
United Iron Works, Inc.

Push Cars
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Push Car Bearings
Timken Roller Bearing Co.

Rail Anchors
Bethlehem Steel Co.
Coover Railroad Track Brace Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Anti-Creepers
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Rail Benders
American Chain Co., Inc.
Buda Co.
Q. & C. Co.
Verona Tool Works

Rail Bonds
Verona Tool Works

Rail Braces
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Buda Co.
Coover Railroad Track Brace Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

Rail Expanders
Ramapo Ajax Corp.

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Rail Layers
Maintenance Equipment Co.

Rail Saws, Portable
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q. & C. Co.

Rail Springs
Verona Tool Works

Rails, Girder
Bethlehem Steel Co.

Rails, Tee
Bethlehem Steel Co.
Carnegie Steel Co.

Regulators, Oxy-Acetylene
Oxweld Railroad Service Co.

Replacers, Car & Locomotive
American Chain Co., Inc.
Buda Co.
Q. & C. Co.

Retaining Walls, Precast
Federal Cement Tile Co.
Massey Concrete Product Corp.

Rivets
Bethlehem Steel Co.

Rock Hammers
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.

Roof Slabs
Federal Cement Tile Co.
Massey Concrete Products Corp.

Roofing, Cement & Concrete Tile
Federal Cement Tile Co.

Roofing Composition
Lehon Co.

Rules
Lufkin Rule Co.

Rust Preventive
Dearborn Chemical Co.

Saws, Electric
Reed-Prentice Corp.

Saws, Pneumatic
Reed-Prentice Corp.

Scales, Tape
Lufkin Rule Co.

Scoops
Ames Shovel & Tool Co.

Screw Spikes
Illinois Steel Company

Screw Spike Drivers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

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Sharpeners, Rock Drill Steel
Ingersoll-Rand Co.

Sheathing Paper
Lehon Co.

Sheet Iron
Armco Culvert Mfrs. Assn.

Shingles, Composition
Lehon Co.

Shovels
Ames Shovel & Tool Co.
Verona Tool Works
Woodings Forge & Tool Co.

Shovels, Steam
American Hoist & Derrick Co.
Northwest Engineering Co.

Signal Foundations, Concrete
Massey Concrete Products Corp.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Slabs, Concrete
Massey Concrete Products Corp.

Smoke Stacks
Massey Concrete Products Corp.

Snow Melting Device
Lundie Engineering Corp.
Q. & C. Co.

Snow Plows
Jordan Co., O. F.
Q. & C. Co.

Spades
Ames Shovel & Tool Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Company

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Spreaders, Ballast
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Stands, Switch & Target
Bethlehem Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel, Electric Furnace
Timken Roller Bearing Co.

Steel, Open Hearth
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Steel, Special Analysis
Timken Roller Bearing Co.

Step Joints
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Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Switch Guard
Ramapo Ajax Corp.

Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switchmen's Houses
Massey Concrete Products Corp.

Switchpoint Protector
Maintenance Equipment Co.

Switchstands & Fixtures
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

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Tapes, Measuring
Lufkin Rule Co.

Tee Rails
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Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Lundie Engineering Corp.
Q. & C. Co.

Ties
Jennison-Wright Co.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Rods
Bethlehem Steel Co.

Tie Scorer
Woolery Machine Co.

Tie Spacer
Maintenance Equipment Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber
Southern Cypress Mfrs. Ass'n.

Timber, Creosoted
Jennison-Wright Co.

Tools, Drainage
Ames Shovel & Tool Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Ames Shovel & Tool Co.
Buda Co.
Maintenance Equipment Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

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Track Gages
Buda Co.
Kalamazoo Railway Supply Co.

Track Insulation
Q. & C. Co.

Track Jacks
See Jacks, Track

Track Levels
Kalamazoo Railway Supply Co.

Track Liners
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Track, Special Work
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Track Tools
See Tools, Track

Trestle Slabs
Massey Concrete Products Corp.

Trucks, Hand, Steel
Anchor Post Fence Co.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Ventilators
Q. & C. Co.

Water Treating Plants
Dearborn Chemical Co.

Water Supply Contractors
Layne & Bowler, Inc.

Waterproofing Fabrics
Lehon Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding & Cutting Equipment
Electric Railweld Service Corp.
Oxweld Railroad Service Co.

Welding, Electric
Electric Railweld Service Corp.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Well Systems
Layne & Bowler, Inc.

Wheels, Hand & Motor Car
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

Wire Fencing
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

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ALPHABETICAL INDEX TO ADVERTISERS

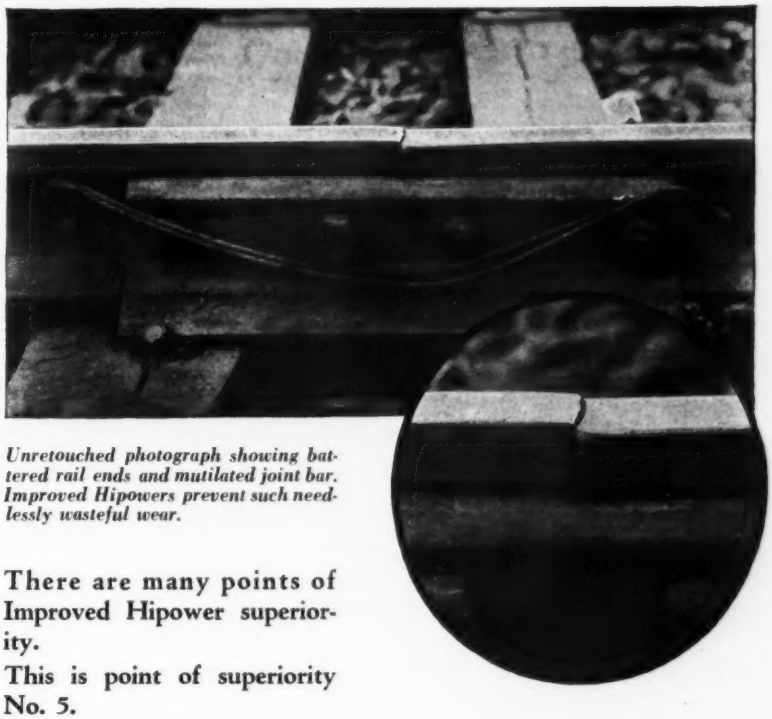
IMPROVED HIPOWER THE STANDARD

IMPROVED HIPOWER is usually specified. Sometimes as a matter of course because it is generally accepted as the standard by most roads.

Sometimes because one or two of its points of superiority meet a special condition.

We want it to remain the standard of railroad spring washers always, but we also want its many specific advantages to be well known everywhere.

That is why in most of our advertisements this year we take up the many points of IMPROVED HIPOWER superiority one by one. Whenever it is specified, it should be with the full knowledge that it is, for several sound reasons, the best that can be had.



Unretouched photograph showing battered rail ends and mutilated joint bar. Improved Hipowers prevent such needlessly wasteful wear.

There are many points of Improved Hipower superiority.
This is point of superiority No. 5.

THE REACTIVE RANGE OF IMPROVED HIPOWER IS DESIGNEDLY LIMITED

TO be effective a spring washer must have power enough to meet and overcome excessive blows. It must never permit the impact to carry through and mutilate the joint bars and batter the rail ends. But in addition to this the spring washer must be powerful enough to *limit the range or extent* of the spring movement. Otherwise there is constantly accelerating wear,—*deterioration.*

No plain coil spring washer can be made that is capable of functioning as a spring under pressures that are met every day on railroads, but IMPROVED HIPOWER, because of its superimposed curves, has such tremendous reactive power that it is commercially non-flattenable.

It snubs effectively. Primarily it retards wear and secondarily it compensates for the gradual wear which inevitably occurs.

And it costs 90% less per 1000 lbs. pressure than plain coil spring washers.

There are many other points of superiority. Our advertisements will announce them.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

IMPROVED HIPOWER

Commercially Non-flattenable - - Permanently Rust-Proof